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August 1, 1918

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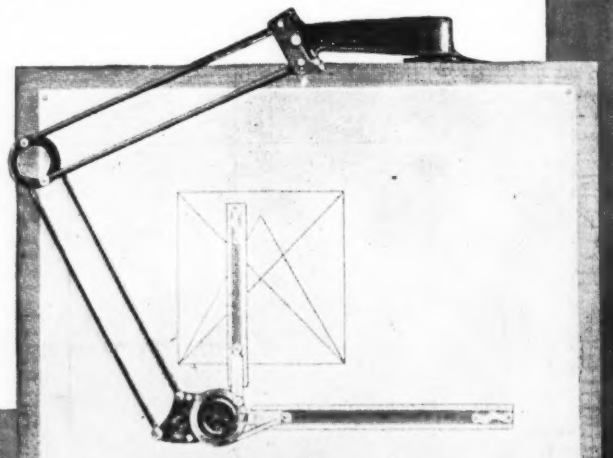

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Volume 81 August 1, 1918 *Number 5*

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E. J. MEHREN, *Editor*

CHARLES WHITING BAKER, *Consulting Editor*

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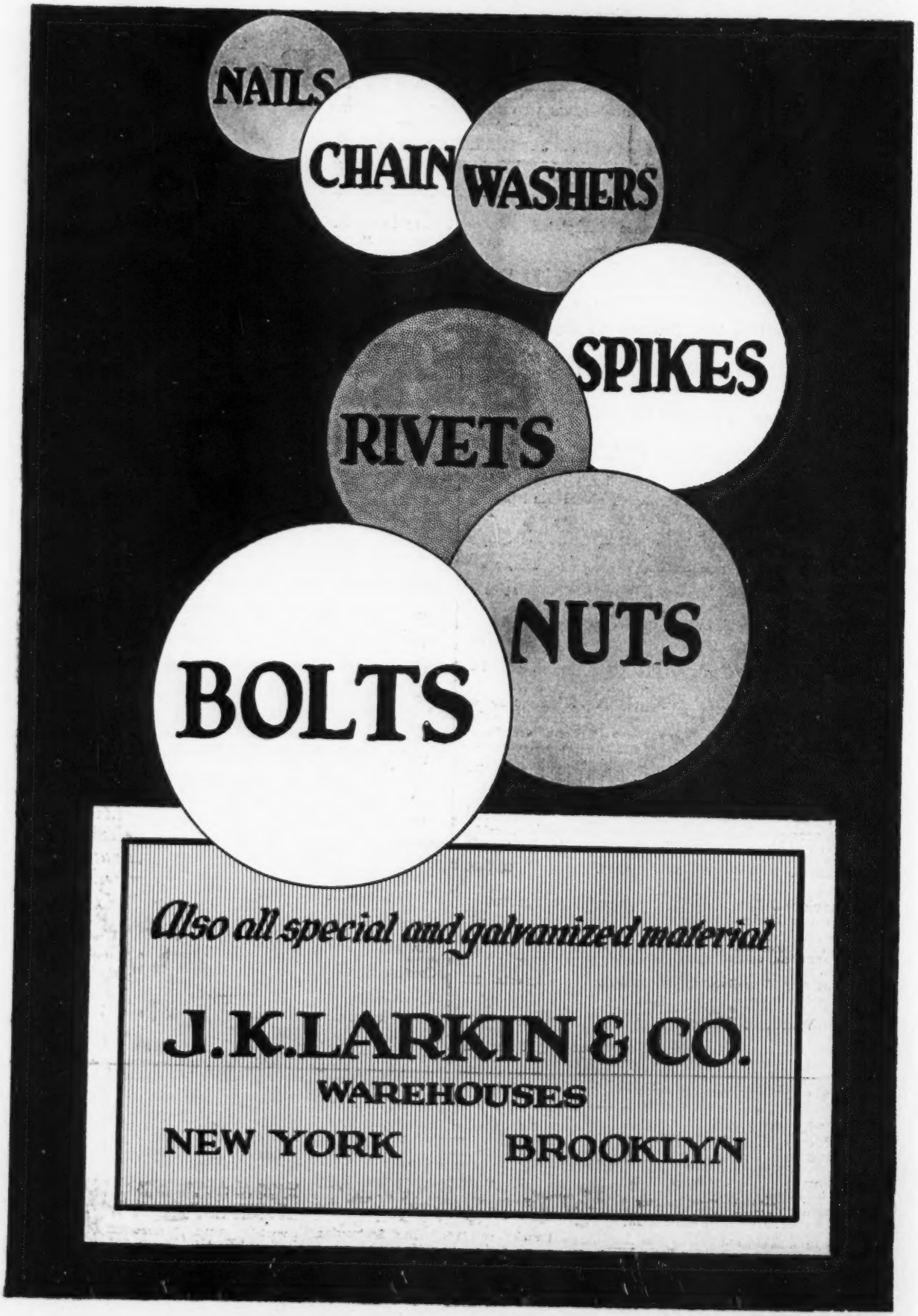
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ENGINEERING NEWS-RECORD

A WEEKLY JOURNAL
DEVOTED TO CIVIL ENGINEERING
AND CONTRACTING

E. J. MEHREN, *Editor* — CHARLES WHITING BAKER, *Consulting Editor*

Volume 81 — NEW YORK, THURSDAY, AUG. 1, 1918 — Number 5

Engineers May Help Carry Meter Ordinance at Chicago

POSTPONEMENT, not defeat, was the outcome of the drive for cutting water waste and saving an immense tonnage of coal by the adoption of a water-metering ordinance at Chicago a few days ago. The American Association of Engineers has taken a hand in the movement for meters. If all Chicago engineers join forces the ordinance may be taken from the file and passed next September.

Adjusting Salaries to the Cost of Living

ENGINEERS in city or other governmental work who have had no increase in salary during these years of rising prices may well be interested in the account of the far different experience of the engineering employees of Cuyahoga County, Ohio, on p. 238. The story had added interest because the scheme for adjusting each month's salary to the cost of living is told by the engineer who worked it out. In some happy future day not only salaries but also other prices may be based on commodity price averages instead of the unstable dollar.

St. Louis Faces Possible Garbage Disposal Dilemma

ANOTHER city is about to go through the farce of receiving bids for garbage disposal by reduction for a very short contract and that, too, just as the existing contract expires. This time it is St. Louis. It invites bids Aug. 6 for a 400-ton plant which must be in operation on Sept. 1, as noted last week on p. 149. Such action is taking the chances of giving the new contract to the present contractor on his own terms. Before doing that, the city should seriously consider disposal by feeding to hogs. Had St. Louis followed sound engineering advice it would not be facing such a situation.

Zoning Progress Should Be Accelerated

CITY zoning makes progress. It should be emphasized at present, since it requires small expenditure of either money or man power, enables cities the better to meet war conditions and will be of immense aid when general building operations revive after the war is won. Following not far after New York City, the second large municipality to adopt a zoning plan is St. Louis. Building use, height, and area districts have been created in that city which will take effect immediately. Salt Lake City has called in an expert to assist in working out a zoning scheme. The San Francisco City Planning Commission is giving the subject attention. Other cities have adopted or are working on zoning plans. The good examples thus set should be followed by cities large and small throughout the country. Here is an opportunity for engineers and engineering societies to render great service to their communities.

Rural Against Federal Sanitation

NEW EGYPT, N. J., is puzzled if not indignant. It does not understand why it should be pressed to abolish privies, cesspools and manure piles for the benefit of visiting soldiers from Camp Dix when it is suffering what it believes to be a far worse nuisance occasioned by the camp sewage. The facts appear to be that the Camp Dix sewage works are badly overtaxed and are polluting the stream which receives the effluent, and flows through a pond in New Egypt. It is alleged that bathing and boating in the pond, once an asset of this New Jersey summer resort, are now impossible, and that the near-by residents suffer from bad odors. Presumably the War Department will soon enlarge the disposal plant. Certainly, the Government should set a good rather than a bad example in sanitation.

Seeing Is Believing: Or Mud, Meters, and Filters

SASKATOON has taught a lesson to Ottawa, or at least to the Mayor of the latter city, and has thus shown once more that the smaller and more progressive cities of the western part of the continent can teach the larger and more conservative cities of the East, if the latter are only willing to learn. As many of our readers know, Ottawa has been backing and filling with its very pressing water-supply questions for many years. It has turned down projects for slow-sand filters, for mechanical filters and also for gravity supplies from sources which were supposed not to require filtration. Journeying westward, Mayor Fisher of Ottawa on approaching Saskatoon noted the very muddy character of the water of the Saskatchewan River. On reaching his hotel he was apprehensive of the quality of water he would find, but was pleased with its tasteless and colorless condition, and found on investigation that a "small, inexpensive filtration plant" worked the transformation. Promptly he wrote back to his home city urging that "we forget that there ever was a water question in Ottawa," and saying that a filtration plant would be

a good investment even if it were scrapped after ten years on account of the introduction of one of the proposed gravity supplies. A further contrast in water-supply matters was found by Mayor Fisher at Saskatoon. His letter home states: "For a long time last winter, Ottawa pumped daily from 250 to 300 gal. for every man, woman and child in the place. The maximum pumped in Saskatoon during the same period was 72 gal. per capita. This is all the more remarkable in view of the fact that for weeks at a time the thermometer stands at —20° F. in Saskatoon." Every service in Saskatoon is metered, Mayor Fisher reports. The lesson is obvious. Unfortunately Ottawa is not the only city that prefers to pump and waste an immense quantity of muddy or otherwise unsatisfactory water, rather than curtail consumption by the use of meters and thus make filtration a comparatively inexpensive proposition.

Studying Projected Railway Lines From a Different Standpoint

THE Federal railroad administration has been petitioned to approve and provide funds for the completion of the branch of the Grand Trunk Ry. in southern New England to Providence, R. I., which was partly constructed in 1911-12. It is claimed that this additional outlet to tidewater from the Grand Trunk system would help relieve congestion on New England railways.

How brief is the time since those stirring events in railway history, of which that Providence extension of the Grand Trunk was a part, and what revolutionary changes have occurred since then! One recalls the ambitious projects for which the late Charles M. Hays, as president of the Grand Trunk, was responsible, and his reception in Providence and Boston and other New England cities, where he painted glowing pictures of the benefits of railway competition, while the countryside was excited by the operations of mysterious surveying parties, and New England imagined it was to witness another era of competitive railroad promotion and construction such as had prevailed a half century before.

Then came Hays' tragic death on the ill-fated "Titanic," followed by the revelation that the financing of his ambitious projects was not provided for. It was, in part at least, the public disappointment over this fiasco that led to the legislative investigation which revealed first the New Haven and Grand Trunk agreements and fallings out over New England territory, and later the extent to which the New Haven financial structure, once a tower of strength, had become a hollow shell.

Whether or not we are to return after the war to private ownership of railways, it seems unthinkable that we shall return to the old-time competitive railway construction—the building of strategic lines, not for public benefit but to defeat a rival. The public will never again look upon the railways of the country as private business enterprises as it did in the past, nor will it long endure any system of control that does not place the public interest first.

This means too that engineers will have to study railway construction problems from a broader standpoint than was ever possible in the past. Instead of the old-time questions, what profit will this proposed line yield to the company which is to own it, or what injury will it do to a competitor, the engineer must determine the problem whether the proposed line will render a service to the public that will make its cost a justifiable investment. If "public convenience and necessity" demands the construction of a road, then it may be built. If the contrary is the case, the construction cannot be permitted.

Contractors and Unions

CONFUSION threatens in the construction field at the close of the present war emergency—confusion which will be costly to the contractors, to the public and to construction labor. In the first place, readjustments caused by price reductions and the dissipation of our great abnormal holdings of gold will present difficulties which can be solved only through most careful planning. In addition, existing union wage agreements have been extensively superseded through Government intervention. Contractors and union workmen will, when the present rush of war work is over, find themselves without a basis of understanding on so many kinds of work that an unprecedented amount of bargaining will be required. Then, there is a general feeling among contractors on war work that the Government, in its anxiety to assure uninterrupted prosecution of vital projects, has gone more than half way to meet demands, and has in some cases established precedents founded rather on the urgency of the moment than upon sound economic principles.

Wages and working agreements which increase the cost of construction beyond a certain point must ultimately be readjusted, as they restrict the volume of work. If new construction is too costly, industrial enterprises cannot afford it. This results in failure to provide necessary facilities, which restricts the production of goods and reacts adversely for the entire population. The construction worker is directly and quickly affected, as the volume of work is held far below the point necessary to keep all employed.

The mere matter of increased wages and shorter hours of work, taken by itself, does not alarm the contractor. Indeed, where such conditions attract a better class of men to the field and improve the efficiency of the worker, they may lower costs, make more work possible and react favorably for all concerned. But many doubt seriously that high wages have so far had such an effect. Indeed, this result could hardly be expected in the absence of any effort to educate the worker in the basic principles that underlie the situation. The worker does not realize that the country cannot support high wages in one particular industry, unless unit production in that industry is so great that the labor cost of the things made compares favorably with the labor cost of other products. The construction workman rarely appreciates that his interest and that of the contractor in lowering the labor cost of construction—a thing quite different from the wages paid—and in maintaining a steady volume of business, should be identical. The reason organized labor has not yet seen the matter in this light is that those who have so far attempted to educate it along economic lines did not themselves, for the most part, have the necessary breadth, or were clever demagogues, each with an axe to grind. The right sort of

education, however, must come before there can be any real progress.

Split into dozens of sectional organizations, contractors will be at a hopeless disadvantage in the wholesale bargaining for new working conditions which must follow the war. Neither can contractors hope, without a national labor policy, carried out in every section of the country through a national organization, to avoid serious losses incident to the readjustment that will be forced in the money measure of wages. It will be all very well, after prices have fallen and there is no Government work to pay high labor costs, to tell a union official that his men can live better on $4 a day than was possible during the war on $6. It will be quite another matter to convince this same official that unless his men do live on $4 a day there will not be any work for them, and to make him see that this will not be the fault of contractors or of any other one group of interests.

To meet this situation planning of national scope should be under way at the present moment. The best brains that the contracting industry can produce and the men most successful in dealing with organized labor should be engaged on it. National planning and the concentration of the best minds in the construction business on the labor problem can come only when there is a representative national organization of contractors. The movement on foot to form such an organization, which had its inception at Atlantic City, and which is noted in the news section of this issue, cannot reach fruition a day too soon.

Is Sewage Treatment an Essential Industry?

ALBANY'S desision not to put its new sewage-works in operation, noted last week, raises an interesting question. Is sewage-treatment an essential industry? A well considered answer to the question must be based on the law of relative values and on the local conditions affecting each sewage-works. Such an answer must take into account the need of the nation and its allies for money, material and men to win the war; how the individual city can best utilize its curtailed funds, supplies and man power; and, last but not least, how much *actual* rather than *theoretical* good the operation of the works will do.

It might not be well to raise what at first thought may seem so reactionary a question were it not for a belief, based on observation extending over practically the entire history of sewage-treatment in America, that a large percentage of our sewage-works have been built under false assumptions of what can reasonably be accomplished, and that the country is dotted over with plants which are so inefficiently run as scarcely to justify the expense of operating them even in peace times. In the present emergency, all sewage-works should be given a searching examination with a view to shutting them down where they are not helping win the war or seeing that, if really essential, they are made efficient. The scrutiny should be all the closer in the case of plants which require coal or other fuel for their operation and which are located in parts of the country subject to coal shortage, as is the case at Albany. The difficulty of getting and keeping trained operators, and the certain inefficiency of many if not most sewage-works without them, is another factor to be considered in deciding whether the operation of sewage-works in these war times is justifiable.

A few words may be said for the benefit of those who have not followed sewage-treatment closely or who for any other reason are not correctly informed as to its aims and possibilities. The real function of most sewage-works is to prevent nuisance. Of those fittingly designed to protect the public health in any marked degree very few indeed are so operated as to insure the attainment of that end.

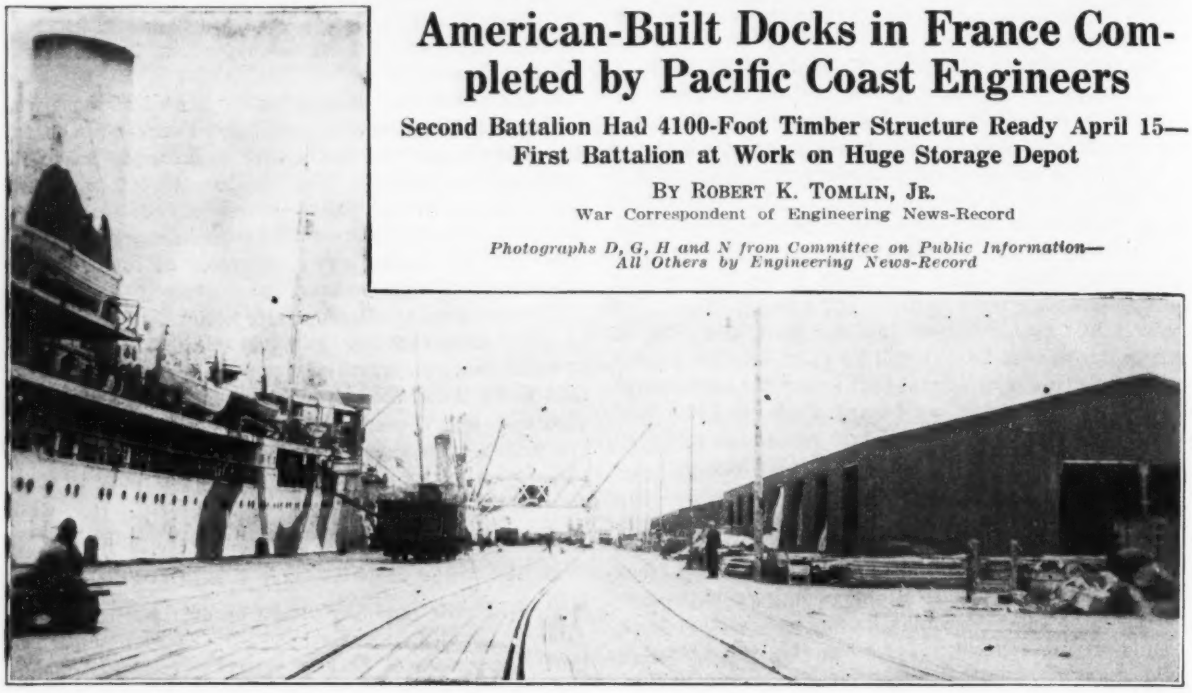
This is a time to clear up false notions. Let us ascertain just what each sewage-works of the country should be called on to do from the viewpoint of relative values; shut down those works which are not needed and take vigorous steps through local, state and if need be Federal action to see that those plants having a vital service to perform do not continue to shirk their duty to their community and the world.

State Bars Against City Improvements

WHEN the qualified voters of a city declare 8444 to 128 in favor of a bond issue for municipal improvements, as was done at Atlanta recently, any one not familiar with the vagaries of state legislative restrictions on municipal activities would naturally suppose that the city concerned could go ahead with the desired work. Not so in Georgia. State legislation there requires that bond issues must be approved by two-thirds of the registered voters at the time of the election. Therefore, although the vote was 66 to 1 in favor of the proposed $800,000 bond issue at Atlanta, the improvements are held up because 784 more votes were required to meet a high and arbitrary statutory requirement. Of the proposed bonds $500,000 were very badly needed to carry out improvements to the water-works, some of which should have been made years ago and which are now doubly needed to meet city and cantonment conditions incident to the war. The emergency is so great that Mayor Candler has generously offered to underwrite $250,000 pump contracts in order that citizens and soldiers may not be threatened with water famine. Atlanta's sister city, Macon, profiting from Atlanta's experience, rallied a small margin of votes for a $200,000 bond issue by dint of hard work.

Throughout Ohio for several years past all municipalities, large and small, have been at their wit's ends to meet operating expenses owing to rigid taxation and restrictions. New Orleans is even worse off than the Georgia and Ohio cities. It has to secure amendments to the State constitution before it can embark upon quite ordinary municipal enterprises, such as a garbage reduction plant.

The time has come to sweep away many of these absurd State restrictions on city activities. This does not mean that no limit should be put on the taxing and bonding powers of cities, but that the limits should be reasonable. As a rule, too, State constitutions should be kept free from municipal bond and tax restrictions; and the state legislatures should attempt to lay down only broad limits or principles, leaving details to be handled by some central administrative body, whose decisions would be made after expert investigation.



American-Built Docks in France Completed by Pacific Coast Engineers

Second Battalion Had 4100-Foot Timber Structure Ready April 15—First Battalion at Work on Huge Storage Depot

By Robert K. Tomlin, Jr.
War Correspondent of Engineering News-Record

Photographs D, G, H and N from Committee on Public Information—All Others by Engineering News-Record

AT AMERICAN-BUILT docks in France transatlantic freight from American-built ships has been unloaded, classified and routed to the front via American-built railway yards since the middle of April. With brand-new berths for 10 vessels, in addition to an existing string of docks near by, previously constructed by the French, the great marine terminal at Base Section No. — of the American Expeditionary Forces, a timber structure supported by wooden piles, extends for almost a mile over a site which was nothing but mud flats half a year ago. Long, low classification sheds flank the shore side of the docks; further inland a receiving yard and a departure yard for the handling of empty and loaded freight cars are well along toward completion; specially designed timber rigs, for the handling of ships' cargoes, and heavy steel gantry cranes are being erected; railway cars and motor trucks, in a steady stream, flow along the quay, picking up their burdens of freight for transport either directly to the advance section, or for storage at the base or intermediate depots.

Busy Scenes at the Docks

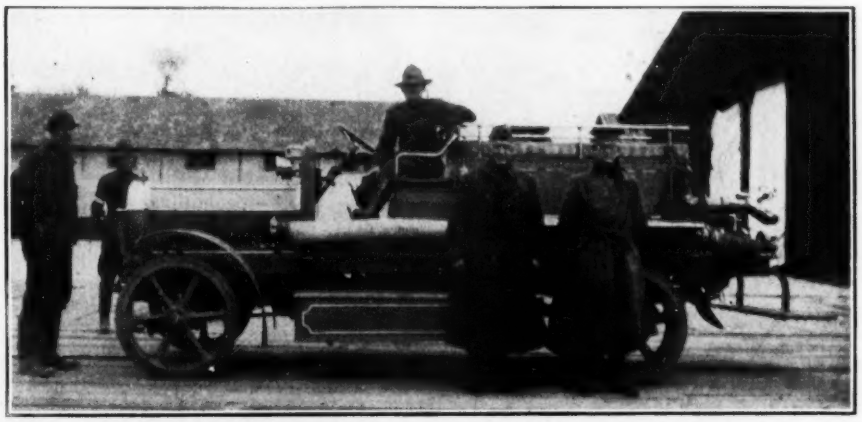
This is the scene at the docks: A solid background of spars, rigging and weirdly camouflaged hulls motionless at their moorings, and a foreground of action kaleidoscopic in its variety. Booms are swinging crates from ships' holds, engines are spotting cars along the quay, negro stevedores are trucking loads into the classification sheds. Motor trucks are darting to and fro over the broad timber flooring, and labor gangs are grading and laying railroad track back of the classification sheds. Here is a group of Spaniards, in brown corduroys and canvas slippers, unloading crushed stone from cars; there, German prisoners in the faded remnants of field-gray uniforms, piling lumber under the direction of a blue-coated French guard with a long bayoneted rifle slung over his shoulder. Back along the road which parallels the waterfront pass truck-loads of Chinese powder-factory employees, or negro stevedores going to or from work. Things are moving down at the American docks in France.

But what of the men who set the stage for this spectacle—the engineers who took the plans of the docks and transformed lines on blueprints into realities of timber, concrete and steel? Their job on the main dock structure practically completed, these constructors have stepped back from the center of the stage to make way for the operating forces, but they have left behind them a convincing record of achievement since they landed in France last September.

Men from Pacific Coast Did Work

The construction of the new docks and yards at Base Section No. — is largely the work of the second battalion of an engineer regiment consisting of men from the Pacific coast. It is a "hand-picked" organization of volunteers, for the regimental quota of about 1700 was culled from 6000 applications. Its commanding officer is the chief engineer of Base Section No. —, and, in addition to the dock and railway-yard construction, he is responsible for a score of other big projects—an immense general storage depot and railway yard, which is in charge of the first battalion of his regiment; hospital construction, railroad extension, ordnance warehouses, engine terminals, car-erecting plants, repair shops, a refrigerating plant, etc., all of this work being scattered over an area of a great many hundred square miles. The construction program in Base Section No. — is staggering. For example, entirely separate from the dock work—a huge job in itself—is the general storage depot six miles distant, which will consist ultimately of 144 warehouses, each 500 x 64 ft. in plan, and a railway yard with 170 miles of track.

To anyone familiar with the army transport problem in France, the fact that the American docks at Base Section No — have been built and in operation for some time past is big news. It means *more tonnage* and, consequently, a general speeding up of construction work throughout the areas of France occupied by the American forces, for the big obstacle in the way of more rapid progress in the past has been delay in the deliveries of construction plant, construction materials and construction men. Everywhere I have gone I have heard this same story—not a complaint, but a frank statement of conditions as they have been. Lacking peace-time facilities for the handling of large-scale jobs, our engineers have succeeded in making progress without them. When machinery does not arrive the only recourse is hand labor. When the erection of a warehouse calls for a bill of timber of certain sizes and lengths, and nothing of the sort is to be had, something else must be made to do. It is no new experience for our men to build up 4-in. timber members from 1-in. stuff.



A. WOODEN DOCKS ARE PROTECTED BY MOTOR-DRIVEN FIRE-FIGHTING APPARATUS—IN FOREGROUND, MAJOR COMMANDING ENGINEER BATTALION AND CAPTAIN WHO HAD IMMEDIATE CHARGE OF DOCK CONSTRUCTION

And that is the important point about the engineering work for the army in France. It must get along with the tools and materials at hand. It would be misleading and unfair to the men who have accomplished such wonders with the facilities available to picture the construction program over here as a sort of triumphal march over smooth roads. It has been nothing of the sort. It has been pretty hard sledding all the time, but never so hard as to make our men let up in their efforts to put the job through. And, in the case of the docks, they have put the job through splendidly, these engineers from the Pacific slope, for there is a great deal of the pioneer in their make-up, the sort of stuff inbred by life in the great open country of the West, which enables a man to face new and difficult conditions with a calm confidence in his ability to win out ultimately. And so, when they needed a sawmill for framing timber, for example, and could not get one ready-made, they ferreted out a steam boiler here, an engine there, other accessories where they could find them, and in a little while the outfit was assembled and cutting timber. "See that two-story classification shed down at the end of the docks?" asked Major R——, commanding the second battalion during my visit to the job. "The floor joists are the only sticks in it which are in accordance with the blueprint plans!" *But the building was up and ready for service.*

On the docks and railway yards the force comprised about 2500 men, including the engineer troops, labor battalions and a crew from the Phœnix Construction Company.

At Base Section No. — large shipments of transatlantic freight are being handled—just how large I am, of course, not in a position to say—but it should be realized that not all of our cargoes from the United States are being received at this one port. However, in the scheme of transport and supply to the front, this terminal is playing a large part. In a former article on the advance depot (see *Engineering News-Record* of July 4, p. 27) I outlined the general scheme of zoning and distribution back of the front. There are, as the main parts of the transportation and supply system, the advance depot, the point of distribution nearest the front; the intermediate depot, somewhere between the advance depot and the seacoast; and finally, the base depots, which are, of course, bigger than any of the others. Freight from ships, in the case of Base Section No. —, is passed either directly into railroad cars or into the classification sheds along the inner wall of the quay, and thence goes by rail either directly toward the front or into the huge base storage depot, from which it is later removed on requisition. The new docks at Base Section No. — parallel the waterfront and are 4100 ft. long, with berths for handling 10 ships simultaneously, as previously noted. Timber flooring, 86 ft. wide, carrying four parallel lines of standard-gage railway track and one line of 44-ft gantry-crane track, is supported by timber pile bents spaced 10 ft. on centers. As to the choice of the type of structure, it was essential to design something which could be built quickly and

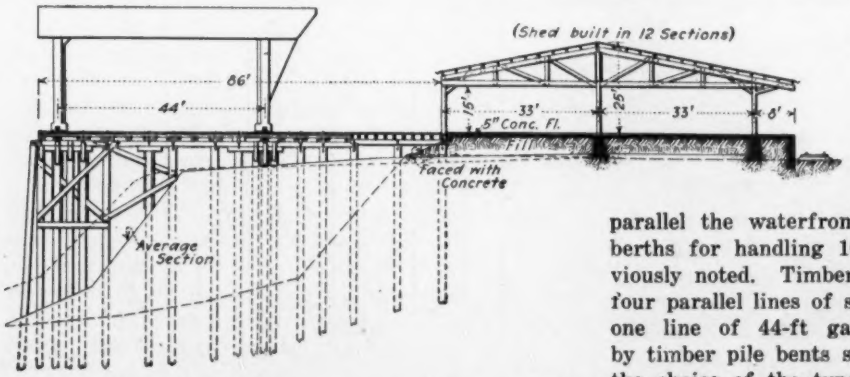
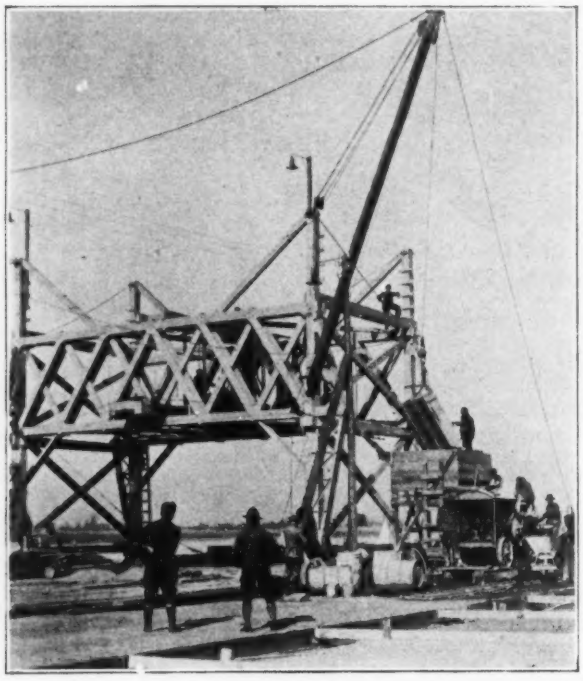


FIG. 1. CROSS-SECTION OF DOCK STRUCTURE AND CLASSIFICATION SHED



B. SPECIALLY DESIGNED CARGO-HANDLING DEVICE BEING USED TEMPORARILY FOR DELIVERING MATERIAL TO PORTABLE MIXER

with materials at hand or immediately in prospect. A wood-pile dock seemed best adapted to these conditions

Too much emphasis cannot be placed upon this phase of the engineering work for the American armies in France. Our men cannot pick up a telephone or a telegraph blank and send in a rush call for the delivery of concrete mixers, locomotive cranes, cement, sand and crushed stone, sawmills, timber piles of predetermined lengths and sizes, dimension lumber, derricks and all of the other plant luxuries of peace-time construction. I say they cannot call for these things, referring to conditions under which the dock work was started late last year. Of course, the situation is improving every day, and our supplies of plant and equipment are now much more satisfactory than formerly. But the engineer at home must constantly keep in mind the fact that all of our work over here was *begun* with mighty few of the mechanical, material and transportation aids to which the engineer in civil life is accustomed. This condition of affairs, however, developed no Micawbers in the ranks of our engineer units; no one waited for "something to turn up." Instead, every one buckled down to the job, with the result that something was made to "turn up"—and that something is the string of classification sheds and the long line of completed quay at which loaded ships from the other side of the Atlantic are now discharging.

The timber structure for the docks was chosen at the beginning as being the only one possible under the conditions imposed on the designers—speed of construction and use of available materials. There is a considerable range of tide at the site (I am not allowed to state this quantity in feet) and the foundation material is a combination of silt and ooze, into which 9200 piles ranging in length from 45 to 70 ft. were driven for the dock structure proper. Piles put down at other places near by swell the total to about 13,000. A number of test piles were driven to refusal before the job was begun, and it was found that they could be depended upon to carry safely loads of 20 tons. The piles are of untreated timber, as no creosoted material was available for quick delivery.

The accompanying cross-section drawing, Fig. 1, renders unnecessary any detailed description of the dock structure. It should be noted, however, that a batter pile, not shown on the main cross-section, is driven under the inner gantry crane rail. While the plans call for three 12-in. steel I-beams under each gantry crane rail, this type of construction was employed only at the

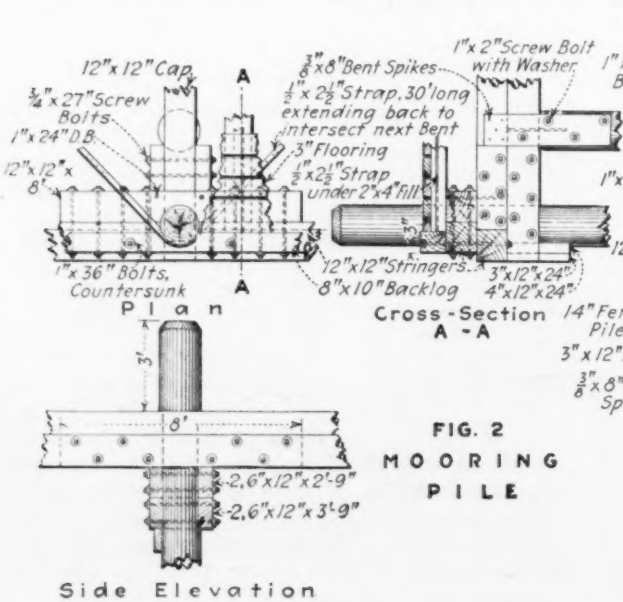


FIG. 2 MOORING PILE

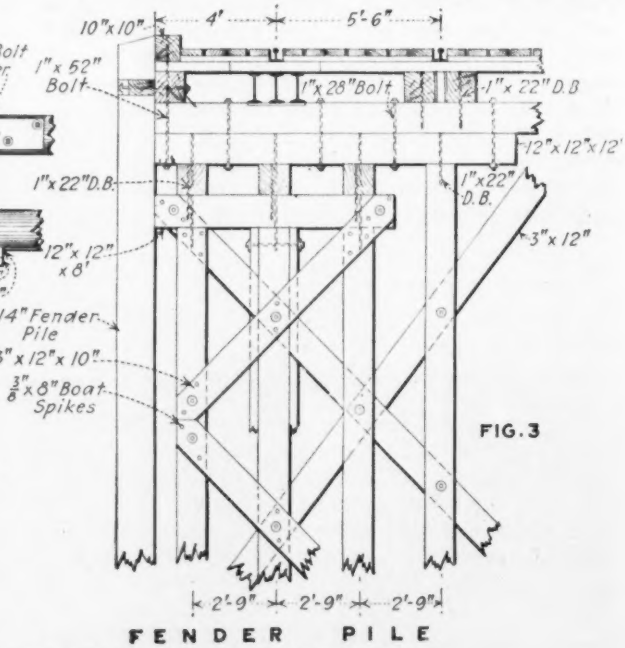
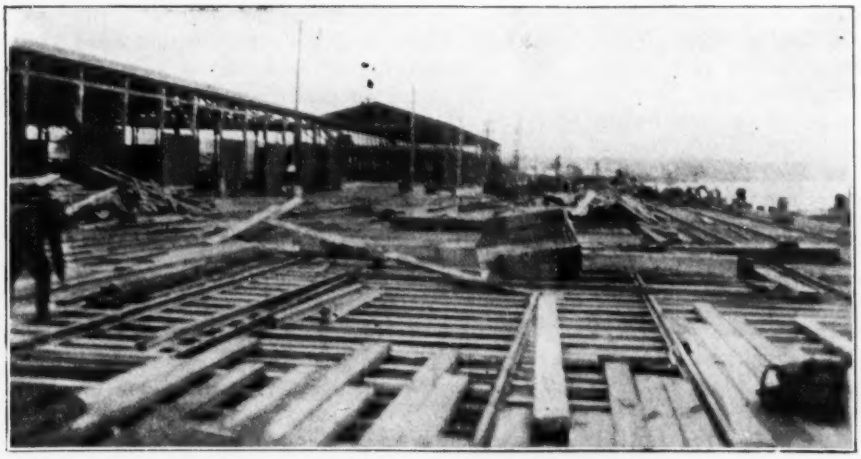


FIG. 3

FIGS. 2 AND 3. DETAILS OF THE MOORING PILE AND THE FENDER PILE



C. AT ONE END OF DOCKS SOME WORK REMAINS TO BE DONE

south end of the docks, where heavy steel gantries will be used. For the northerly section 12 x 12-in. timber stringers support the gantry rails, on which a special and lighter unloading device, shown in Photograph B, will operate. The piles are capped with 12 x 12-in. timbers, the stringers are also 12 x 12 in., and the decking is 3 x 8-in. stuff carried by 4 x 10-in. crossties. Practically all connections are made with 1-in. driftbolts.

For the standard-gage track on the dock flooring 80-lb. rails are used, but the gantry-crane rails are 100 lb. per yard, and are fastened to the ties by hookbolts. The pile bents are cross braced both transversely and longitudinally with 3 x 12-in. timber. Figs. 2 and 3 show the mooring-pile and fender-pile details.

An important feature of the design is the transverse fire walls underneath the decking, at about 300-ft. intervals. They are of solid timber planking to prevent the sweep of flames underneath the flooring along a considerable length of dock. From the photographs it will be observed that the decking planks are brought up flush with the tops of the rails, forming a surface on which motor trucks as well as railway cars may operate. Motor-driven fire-fighting apparatus, shown in Photograph A, is part of the dock equipment.

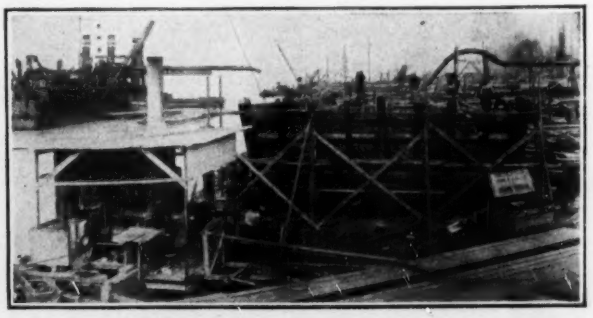
To furnish at a proper level a foundation for the concrete flooring of the classification sheds and open storage areas, it was necessary to make a fill of about 55,000 cu.yd. First, a concrete retaining wall, averaging about 8 ft. in height, was built back of the classification sheds for the entire 4100-ft. length of the docks. At the inshore side of the dock structure a dike of puddled clay was formed and faced on the waterfront slope with a 4-in. slab of concrete to prevent washing out by wave action during periods of high water. Between these two walls—the concrete-paved dike on the waterfront side and the concrete retaining wall on the shore side—the fill was made by hydraulic sluicing. The material is sand-dredged at a point 40 miles from the dock site and delivered by French barges. From the barges moored along the timber quay wall the sand was pumped out by a hydraulic dredge. This fill was compacted by steam rollers before concrete was laid upon it.

The floors of the classification sheds and the open storage spaces between successive pairs of buildings are all concreted, this job involving the covering of an area 4100 ft. long and 76 ft. wide with concrete 5 in. thick. The concrete was placed in transverse strips 12 ft. wide and is not reinforced. In all, three mixers were employed. One rig, shown in Photograph E, consisted of a 1½-yd. mixer, driven by a gasoline engine, the whole outfit being mounted upon a flat car which could be moved along the dock as work progressed. Distribution from this mobile plant to the floor area was by narrow-gage railway and V-shaped industrial cars. In addition there were used two smaller concrete mixing plants, as shown in Photograph F. The capacity of these mixers was ½ yd.; they were driven by gas engines, both mixer and engine being mounted on a low four-wheeled truck. Aggregate and cement were brought in by railway cars operating on the inner one of the four dock tracks. The aggregate was dredged gravel and sand obtained at a point some distance from the docks, and delivered by barges; the cement was shipped from England. With 160 men engaged on the work of concreting the classification-shed floors and open storage spaces, about 7500 sq.ft. of concrete 5 in. thick were laid each day with the three mixers available.

The following summary shows the volume in cubic yards of concrete required by the docks, yards and accessory structures, such as a new warehouse, 100 x 3000 ft. in plan, and a cold-storage plant.

Classification-shed floors	4,400
Retaining wall	3,800
Apron wall	4,400
New warehouse	7,200
Departure yards	2,200
Cold-storage plant	4,000
Total	23,600

Paralleling the docks, the classification sheds are located in a straight line with gaps between each pair for open storage. There are, in all, eight of these sheds; two of them are 312 x 74 ft. in plan, while the other six are 205 x 74 ft. They are timber-frame structures sheathed with corrugated iron, Photograph C showing one of the sheds partly completed. All are one-story in height except the building at the southerly end of



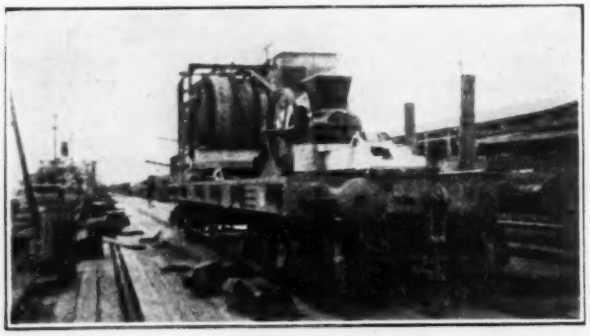
D. DREDGE PUMPING SAND FROM SCOW TO MAKE RAILROAD FILL—NOTE END OF ELEVATED PIPE LINE AT RIGHT, THROUGH WHICH SAND IS PUMPED

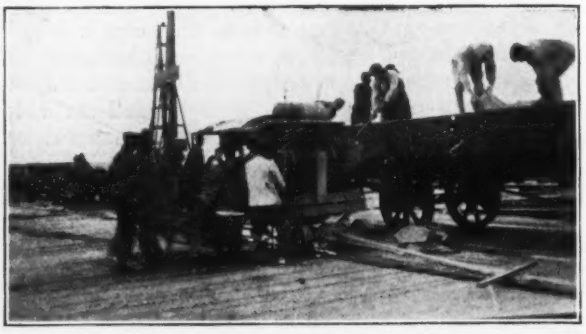
the string (Photograph C), which has a second story which will be used as the administrative offices of the dock-operating force. The cross-section, Fig. 1, illustrates the prevailing type of structure. As a general rule a gang of 50 men worked on one shed. The frame was set usually in one day and the entire structure completed in one week.

All of the timber for these sheds came in the rough from the States. It was framed by a homemade sawmill operated by a boiler obtained from Spain. The engineers were successful in receiving from the States a circular saw, but had to construct for themselves wooden pulleys and mount these on a piece of shafting obtained locally. On this makeshift sawmill most of the framing of timber for the classification sheds was done. The work was started by the making of templets for each member of the building, and with these as patterns the lumber was run through the mill in bunches of half a dozen pieces at a time. The members for the wooden roof trusses were bored by compressed-air tools and connected by bolts. On the erection of the timber framework double-block gin poles were employed.

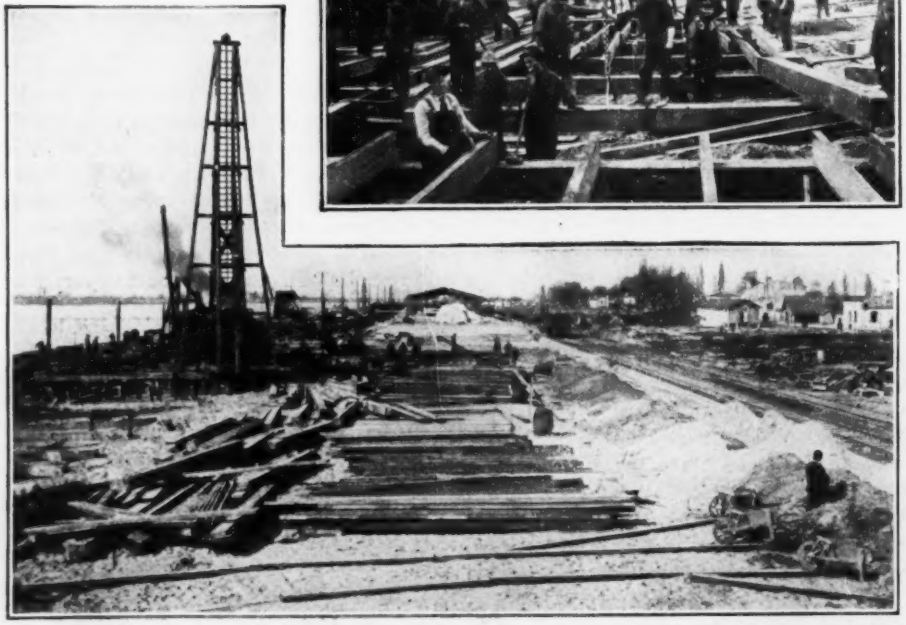
Behind the string of classification sheds are three lines of depressed railroad track, 3 ft. 4 in. below the elevation of the floors. Then comes a platform 10 ft. wide, set at the same elevation as the classification shed floors, followed by a storage warehouse 100 ft. wide with an 8-ft. platform on the inshore side. Flanking this latter platform are two more lines of depressed track at the same elevation as those previously mentioned. Another accessory is a 25-ft. teamway for the use of trucks, followed by two other team tracks, making, in all, six additional miles of trackage in connection with the dock facilities.

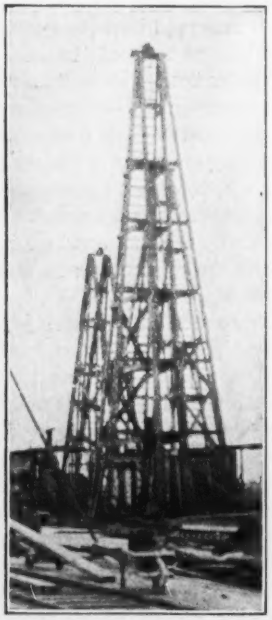
While work on the docks was in progress other detachments of the engineer regiments, assisted by labor battalions, were grading and laying track in the receiving and departure yards. The plan of the whole project is roughly in the form of a quadrilateral whose sides are formed by the line of docks, the receiving yard, the de-



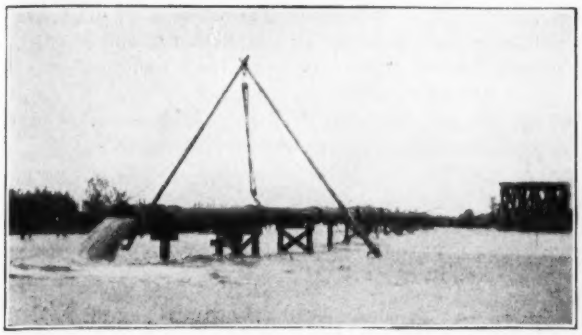


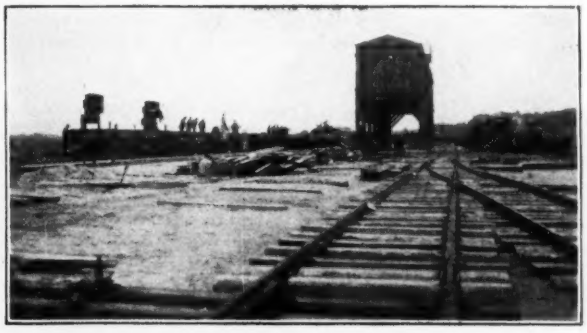
E AND F. MOVABLE MIXER PLANTS USED IN CONCRETING FLOORS OF CLASSIFICATION SHEDS





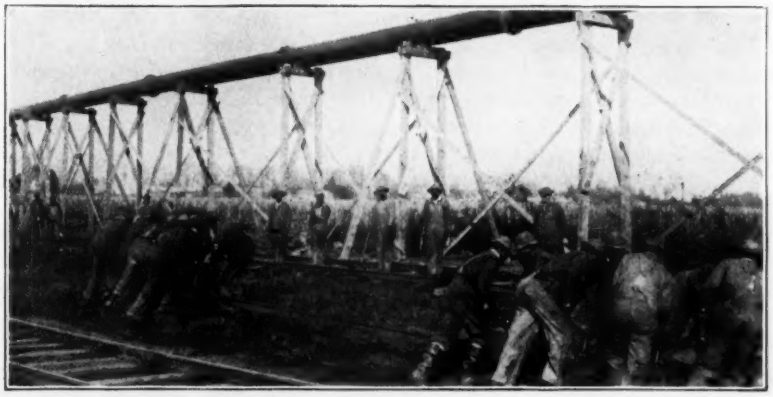
G. CAPPING PILES AND LAYING THE TIMBER DECKING AT THE AMERICAN DOCKS
H. LOOKING ALONG DOCK SITE—PILEDRIVER ON LEFT, TIMBER CLASSIFICATION SHED IN CENTER
J. THE ENGINEERS HAD TO BUILD THEIR OWN PILEDRIVERS AND DERRICKS





K. AT THE DEPARTURE YARD THE FILL IS BEING MADE BY HYDRAULIC SLUICING

L. PLACING FILL AND LAYING TRACK IN DEPARTURE YARD—ENGINEERS BUILT ELEVATOR COAL BINS IN CENTER



M. LABOR BATTALIONS AID IN TRACKLAYING—IN BACKGROUND TRESTLE - SUPPORTED PIPE USED IN MAKING HYDRAULIC FILL

N. OPEN STORAGE FOR SUPPLIES IS PROVIDED AT MAIN DEPOT

O. NEW RAILROAD, 6¼ MILES LONG, LEADING FROM DEPARTURE YARD AT DOCKS TO BASE STORAGE DEPOT—NOTE GRADING FOR ADDITIONAL TRACKS

parture yard and the existing tracks of a French railway to which connections have been made for incoming and outgoing traffic.

Build Piledrivers

On Oct. 1, exactly one month after the engineer regiment arrived in France, the first shipments of piles and lumber from the United States came. At that time the men were without the cant hooks and peaveys with which they had been accustomed to handle lumber, and tools from home were arriving in mere driblets. A batch of French axes and shovels was purchased locally. One of the first jobs was to build piledrivers, derricks, sawmills and planers out of such material as could be found. For the railway yard excavation two 60-ton steam shovels were obtained from Spain. Purchases of French track and piping also were made, while Spain was drawn upon for railroad ties.

In all there were built two floating piledrivers, five skid and two roller piledrivers, and eight skid derricks for handling lumber. While working with the two floating drivers and four of the skid drivers the progress amounted to about 150 piles per day. The first pile was driven Nov. 12 and on Feb. 10 the driving of the 9200 piles for the docks proper was completed. Not all of the nine piledrivers, however, were working until about Christmas.

The piles themselves were of longleaf yellow pine which had been tapped for turpentine. They were driven with 3000-lb. drop hammers by the floating and skid rigs. The timber is not treated in any way, as there was neither the time nor the facilities for any such procedure. Taking into account the alternate wetting and drying of the dock substructure, due to tide variations, the life of the piling is estimated at from 12 to 15 years. Including piling, capping, stringers and flooring, the docks at Base Section No. — represent about 5,000,000 ft. b.m. of lumber.

Where the gantry-crane rails are carried by 12 x 12-in. wooden stringers rather than I-beams, which did not arrive in time to be used throughout the entire length of the docks, a special unloading device is to be used. It is of timber construction, as shown in Photograph B, and weighs considerably less than the 70-ton steel gantry cranes which will operate at the south end of the docks. This unloading device, called the "Boschke," after the name of the captain of engineers who designed it, is about 20 x 44 ft. in plan and consists of a timber-truss frame carrying a pair of 45-ft. ship's booms, tackle and hoisting engine. The rig is mounted on wheels which run on the regular gantry tracks, these being spaced 44 ft. apart. The hoisting equipment, electrically driven, is housed between the two overhead trusses, as shown in the picture. With this rig a line from the water-side boom is run down into the ship's hold and made fast to the load. The load is then hauled up by the hoisting engine and when clear of the ship's deck is swung shoreward, the weight being transferred by means of suitable tackle to the second or inshore boom, which deposits it on the platform of a classification shed.

A speed test of this apparatus, which, its designer explained to me, is merely an adaptation of the practice of generations of seamen in handling freight by ships' booms, resulted in a round-trip time of only 40 sec.; that is, 40 sec. for picking up a load from a vessel, delivering it to the classification-shed platform and returning empty to the point of starting. The device is capable of handling weights of five tons, although in the ordinary course of events the individual loads will average only two tons or less.

Railway Receiving and Departure Yards

The railway receiving yard immediately back of the docks will, when finished, have a track mileage of 6.25. From it connection is made to the main-line tracks of a French railroad. At the receiving yard empty freight cars will be delivered and sent forward along the trackage system on the dock structure as needed. The four lines of tracks on the docks are equipped with double-slip switches, and the layout is such that any one of the ten berths can be pulled without interfering with operations at the others. The construction work at the receiving yard involved nothing unusual in the way of grading and tracklaying, as the ground is fairly level.

The departure yard, where cars loaded at the docks are made up into trains, contains about 18 miles of track. The feature of the grading work here is the employment of the hydraulic sluicing method for making the fill. Sand dredged at a point 40 miles from the docks is brought up in barges and from them pumped by a French dredge boat to the departure yard through a 30-in. steel pipe line about one mile long, carried on timber trestles. Photograph K shows this work in progress. The dredge boat delivers at the rate of 2,250,000 gal. of water per hour, and the flow contains about 10% of sand. The fill required in all the yards amounts to about 450,000 cubic yards.

A number of accessory structures are being built at the departure yard. There are, for example, a group of overhead coal-storage bins (Photograph L) and an engine pit and repair shops of concrete construction, with timber-pile foundation. When I went through the yard, work was just about to start on a huge refrigerating plant. This structure is being built and equipped for a capacity of 7500 tons of meat.

At both the receiving and departure yards much of the grading and tracklaying is being done by American negro labor battalions under the supervision of engineer troops. Two 60-ton American-built steam shovels, hailing from Spain, were cutting down banks preliminary to the grading of the roadbed for track.

Because of the increase of traffic between the departure yard and the general storage depot for Base Section No. —, 6¼ miles distant, it was considered necessary to parallel the existing double-track line of a

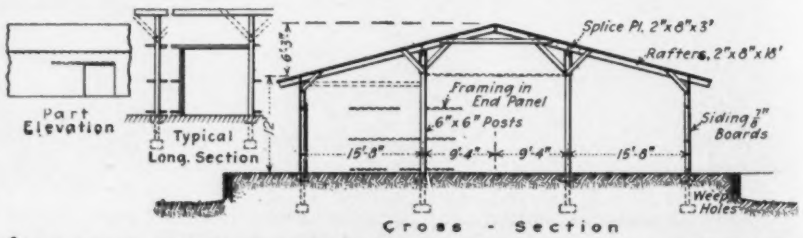
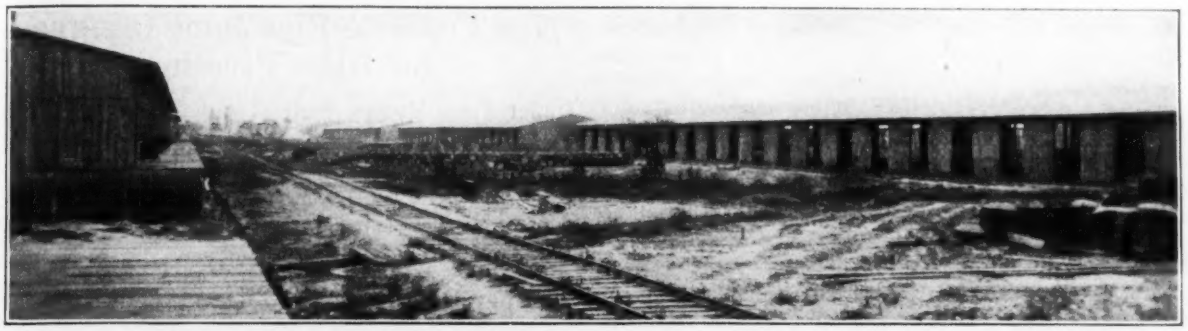
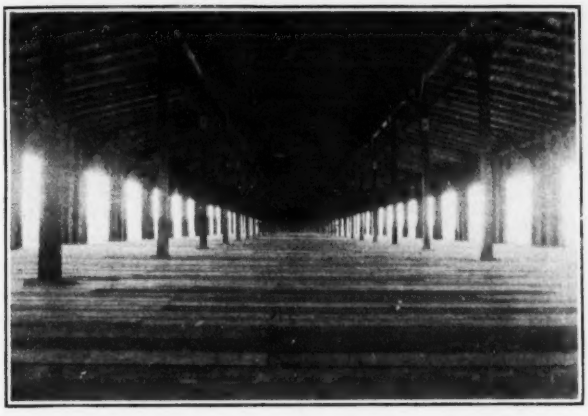
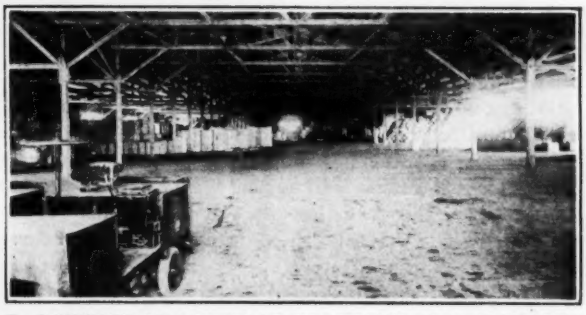


FIG. 4. CROSS-SECTION OF WOODEN WAREHOUSE AT BASE STORAGE PLANT





P AND Q. AT THE BASE STORAGE DEPOT THERE WILL BE, ULTIMATELY, 144 WOODEN BUILDINGS OF THIS TYPE.



R. INTERIOR OF A SHED AT THE FRENCH DOCKS NEARBY

French railway with a third track, which is shown in Photograph O. To provide for future contingencies the new route has been graded for two additional tracks, as shown at the left of the picture, thus constituting, with the existing French tracks, a four-track railroad.

Base Storage Depot and Yards

The base storage depot, which is connected with the departure yards at the docks by the 6½-mile railway line referred to in the preceding paragraph, is an immense project, designed to hold three month's supplies for 2,000,000 men. In its essential features it will consist of 144 wooden warehouses, each 64 x 500 ft.—30 of them were completed at the time of my visit—two railway classification yards, two receiving yards, one departure yard and three storage yards, involving a total trackage of 117 miles—of which 30 miles have been laid at this writing—and 815 switches, of which seven are of the double-slip type. This construction is in the hands of the first battalion of the engineer regiment whose second battalion handled the docks and classification sheds, the engineers being assisted by labor battalions of almost every nationality and by big gangs of German prisoners. The available labor force here numbered about 6000 on the day I called at the headquarters of the engineer captain in charge of the job.

Trained Gangs, in "Waves," Build Warehouses

The sight of row after row of these long wooden warehouses brings to mind the picture of the big-scale cantonment construction in the United States which was begun a year ago. This job at the base depot in France is one of quantity production and is being handled by gangs, each trained in a single specialty. The work has been carefully analyzed and segregated into certain major operations, as is the common practice in the manufacture of munitions, where a shell casing, for example, will pass down a line of machine tools, each operator performing a single operation upon it. Thus, in the case of the 500 x 64-ft. warehouses we have "waves" of construction crews passing in succession over each building. The first gang digs post holes and passes on to the next building. It is followed by a gang which sets the foundation posts. Then come, in order, gangs which saw off the posts at the correct elevations, erect the timber frames, sheathe the sides and finally apply the roofing material. On the warehouse construction about 700 men are at work.

Figure 4 shows the type of structure used for the base warehouses. It will be noted that it involves no roof trusses—merely posts, rafters and knee bracing. The drawing shows the building at the ground level with depressed track on either side, but as a matter of fact many of the buildings I saw were supported on posts to bring the floor and platform level flush with the floor of the freight cars operating on track not depressed but laid at about the general level of the ground.

Design Subject to Change

Of course, it must be understood that the publication of a sketch of this sort does not presuppose a rigid adherence to the theoretical design, particularly as regards the sizes and lengths of the members. The constructors use what they can get. Rafters, for example, are often built up of 1-in. plank. Railroad ties cheat destiny by becoming foundation posts for warehouses. Packing cases, weary with travel, find a permanent resting place as sheathing or bracing. As Captain S—— remarked, "We must be ready to change our designs with each new building erected, depending on the kind of material available for our use." Interior and exte-

rior views of one of the 500-ft. warehouses are shown in Photographs P and Q.

While the dock and railway yard work has been essentially a construction problem, it has made other and exacting demands upon the engineer officers in charge. Upon the fund of experience available in such a regimen as the one which is in charge of operations at Base Section No. —, it is possible to draw for the solution of almost any technical problem. But in the case of the dock and railway-yard project, not all of the difficulties the major in charge of the first battalion had to face were technical. What textbook or field manual gives the construction man the slightest hint of approved practice in mollifying an irate French housewife who has been informed that her house must be torn down to make way for American railway tracks? Over here the little one-story stone dwelling, with its red tile roof, which has been passed down from one generation to another for centuries, is something almost sacred. Surely *les Américains* will not be so stony hearted as to destroy it! The fact that they will pay the French handsomely for the privilege is a matter of secondary, though not of minor, importance. And so the scene in the engineer's office proceeds through the several stages of indignation, entreaty and tears. But our major has had his orders to let nothing interfere with the progress of the job, so he must remain obdurate—and sometimes this is one of the hardest decisions he must make.

Just as I was leaving the docks on my journey back to Paris the Major of the second battalion of the engineer regiment who had tramped over the whole job with me pointed to one of the ships lying along the new timber quay. "She's one of our new vessels," he said, "turned out at a yard in Seattle. Quite a coincidence—she's carrying a cargo of lumber from Seattle, and here she is unloading at a dock in France built by Seattle boys." As he looked out over the line of docks his men had built and spoke of the ship newly arrived from across the Atlantic, there was just a touch of wistfulness in the Major's voice. I discovered later that he, too, came from Seattle.

Street Grading Cost a Ward Charge

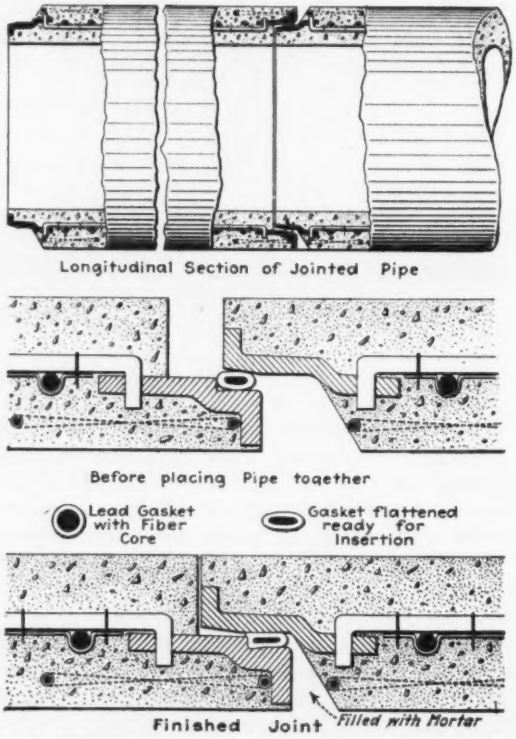
Grading streets and alleys in Minneapolis is a burden that falls upon the whole ward instead of upon abutting property owners. Contrary practice has prevailed for several years through the refusal of the City Council to accept new city plats for record until the streets and alleys have been graded. Recently an owner of 15 acres adjoining Glenwood Park brought suit to compel the City Council to accept the plat without grading. The case went to the state Supreme Court, which decided in part: "The city charter confers broad powers on the City Council in the matter of plats, but it does not confer absolute power of rejection." The court then referred to a portion of the city charter which provides that with the exception of bridges and their approaches, which are a city charge, all other expenses connected with grading shall be taxed upon the entire ward wherein the grading is done. By refusing to accept a plat until the streets are graded, the court held, the city council virtually requires the abutting property to pay the entire cost of grading, which is contrary to the charter provision cited.

New Concrete Pipe Joint Designed for High Pressure

Under Tests Proves Water-Tight for Heads Up to 250 Feet—Can Be Used for Diameters as Small as Four Inches

A PIPE joint capable of standing very high heads, forming an expansion and a universal joint and applicable to concrete pipes of sizes as low as 4 in. in diameter, has been developed by the Lock Joint Pipe Co., New York City. The company has been experimenting with the joint at its works at Ampere, N. J.

The joint is shown in detail in the accompanying drawing. The fundamental principle consists in the use


Longitudinal Section of Jointed Pipe
Before placing Pipe together
Lead Gasket with Fiber Core
Gasket flattened ready for Insertion
Finished Joint
Filled with Mortar

JOINT FOR CONCRETE PIPE MADE WATER-TIGHT

of a special lead pipe gasket which squeezes against the cast pipe ends when the pipes are drawn together and forms a water-tight joint which at the same time permits a certain deformation of the pipes themselves without affecting its tightness. The gasket is of specially made lead pipe of size varying with the size of the pipe to be jointed and is filled with a fiber core which insures continuity of surface when the pipe is flattened and squeezed. Where concrete pipes are used the pipe ends are of specially shaped castings which are placed in the forms before the concrete pipe is poured and, being fastened to the reinforcement of that pipe, become integral with it when the concrete sets. Two pipes are brought together by a screw-jacking arrangement extending back to the last pipe already in place in the line. In the tests in the yard on 4-, 9- and 36-in. pipe the pressure was put on up to 110 lb. per square inch and the pipe moved through a considerable amplitude under this pressure, without showing any leak.

Reciprocity Between National and Local Societies

Directors of Cleveland Engineering Society and A.A.E. Agree on Joint Membership Plan—National Sections Clannish

By C. E. Drayer
Of the Cleveland Engineering Society

MUCH thought has been given to making the engineering profession a solid working unit and to establishing a feeling of brotherhood and mutual helpfulness. While great progress has been made, there is a widespread and growing conviction that the bond must be even closer and that all members should be welded together in the community, in the state and in the nation. Such relationship must be workable, capable of vigorous growth and based upon the proposition of solidarity of the engineering profession for the good of the whole people.

Early this year the intersociety relations committee of the Cleveland Engineering Society proposed in its report a plan "for efficient organization and unselfish coöperation of the entire body of engineers" and recommended "that the national societies consider as a prerequisite to membership that a candidate shall show membership in an accredited local society." The directors of the society indorsed the recommendation, as did also the Ohio Association of Technical Societies and the National Coöperative Convention held in Chicago in May. A member of the Minnesota Joint Engineering Board suggested the following addition to the proposal just quoted: "and as a condition of this membership in a national society, he shall maintain his membership in the local society."

Reciprocity Plan Worked Out for Cleveland By Local and National Boards

Such a plan presupposes that the national and local societies shall be mutually supporting and not competitive. It presupposes also that the national and local societies will be able to work out a reciprocal agreement. Such an arrangement has been worked out and approved by the national board of directors of the American Association of Engineers and the board of directors of the Cleveland Engineering Society. In brief, the proposition is that a member of either society may become a member of the other under very favorable conditions as to entrance fees and dues. At the outset, no entrance fee will be charged a member of either society joining the other. A combined schedule of annual dues amounting to about 70% of the sum of the dues of both societies will prevail. Thus, the sum of the annual dues of the two societies in the active grade of membership is $25, which is reduced to combined annual dues of $18. The entrance fee for the engineer who desires to join both at one time is one-half the sum of both. Thus, the sum of entrance fees of the two societies is $14, the combined entrance fee is $7. The Cleveland chapter of the American Association of Engineers will thus become an integral part of the local society and not affiliated with it. Members of either society taking out the combined membership will be in full standing in both. The Cleveland society stands ready to make equally favorable arrangements with any other national society.

Some attention can well be given to the proposition that the national societies shall insist on membership in local societies as a condition of both new and continued membership in the national societies. Manifestly, this proposition depends upon the broad argument for solidarity of the profession and for the broader good of the people at large. If the general principle of compulsory membership in a local society be accepted, it becomes necessary to work out a plan by which local societies would become coördinated or articulated with the national societies. Discussion is invited to the end that the working arrangement proposed between the Cleveland Engineering Society and the American Association of Engineers may be improved and made applicable throughout the country for any local and any national society.

Would Aid Collective Endeavor

The plan proposed by the Cleveland society and approved by the other organizations above noted would tend to multiply local engineering societies, so that engineers in each locality would be brought into closer fellowship and be able to do those things which can only be done by collective endeavor. The local societies are now, and the new ones would be, very diverse in character and membership requirements. The point may be made that the standards of membership of some local societies are low. Why, then, should a man who is qualified for membership in say the highest grade of a national engineering society be held out of membership simply because he does not care to join the local society whose standards of membership may be low? Such a question presupposes instead of a feeling of common fellowship a pharisaical attitude. *The higher the standing of the individual engineer in the community, the greater is his obligation both to his profession and to the community. This obligation can be met most fully through the local society.* He is shortsighted and narrow if he has not already joined the local society, doing his part to improve, not so much the requirements of membership admission, but the standing and usefulness of those who are entitled to call themselves engineers. On the other hand, it may be said that any articulation of local and national societies would imply a viséing of the membership requirements of the local, hence a tendency to raise the standards of admission, for any man joining the national societies would of course have to meet its standards. No lowering of national standards is contemplated or necessary. It might well be expected that this plan would strengthen the national societies and increase the interest in them. It would gather in those who want to join both a national and a local but because of the expense, particularly of the first year, join neither. It would also, by raising the standards of the locals, tend to make the local societies become training schools for national society membership.

The minute the plan for coördination discussed in this article is proposed, some will say that the national societies already have sections or local chapters whose

geographical boundaries may be extended to state or group-state scope where the number of engineers is too few for city locals. The difficulty in the scheme of local sections of national societies is that it is clannish and tends to separation of local engineers into their special lines. Parenthetically, it may be said that no worse mistake in engineering organization has been made than the extension of the local section idea to undergraduates. Not separation but consolidation is the thing in the social and citizen relations of the engineer. Such ends will be attained by having local societies in every community where a dozen or more members may be had and by having all engineers members of a local society. Local societies can be set up more easily than national sections, for locals include all; sections, national members divided by four or more. The all-inclusive local is the foundation stone for complete unity. The problem, then, is to weld local societies and chapters or sections of national societies into homogeneous wholes in each community. It is felt that a satisfactory beginning has been made in the arrangement between the American Association of Engineers and the Cleveland Engineering Society.

In a discussion of such an arrangement as the one proposed above, there are those who are content only to see and take the next sure step ahead; others, less venturesome, want to know all the path to the end. Both types should be able to discern in their vision of the future the possibility of a single grand American Engineering Society, with technical sections and geographical divisions and subdivisions or chapters. Then indeed would there be no emulation necessary of the splendid work of such organizations as the American Institute of Architects and the American Medical Association, but another professional body of even greater capabilities would arise "for the good of engineers, and for the greater good of the people at large." Let us approach the subject with a "why not?" rather than a "'Yes, but."

Urges That Draft Contract for Federal Railway Operation Is Unfair

Railway Security Owners' Committee Asserts that Railways Are Asked to Give Blind Blanket Warrant of Release—Desires Mutuality of Contract and Provisions for Arbitration and Appeal to Courts

BY FORMER GENERAL MANAGER

IMPORTANT terms of the tentative agreement with the railway companies for the operation of their properties under Federal control appear to be at variance with the proclamation of the President and with the act of Mar. 21, 1918, which clearly set forth the terms under which the roads shall be operated and their owners compensated under Federal control.

The conferences recently held by the railway executives' advisory committee of the National Association of Owners of Railroad Securities demonstrated that in certain important particulars the tentative draft of the contract was not acceptable. The points at issue are very clearly defined by the railway security owners' committee, and their contentions are in the main supported by the act of Mar. 21, 1918, entitled "An act to provide for the operation of transportation systems while under Federal control, for the just compensation to their owners and for other purposes." It is expressly declared in the act that the legislation was enacted to meet the conditions growing out of the war and was not to be construed as expressing or prejudicing the future policy of the Federal Government with regard to railway ownership, control or regulation, or capitalization.

The proclamation of the President of Dec. 28, 1917, and the act itself assure and guarantee to the owners just compensation and fair treatment. It is therefore not unpatriotic on the part of the owners of the railways to assume that the desire of the President and the plain intent of the law should be carried out, and an analysis of the situation will strongly bear out the contentions of the owners' committee.

It appears that the drafting of the agreement has been delegated in the main to subordinate officials of the United States railroad administration, represented principally by lawyers desiring to make a contract as favorable as possible to their client. It would seem that the Director General in his multifarious duties was obliged to delegate this important matter to his subordinates and that, when his attention is finally directed to the matter, the points of variance will be quickly adjusted.

The main features of the tentative draft of agreement not acceptable to the owners' committee are as follows:

1. A release to the Government whereby the owners would waive "any and all claims and rights at law or in equity which it now has or hereafter can have, under the Constitution and laws of the United States, for any and all loss and damage to its business or traffic by reason of the diversion or otherwise which has been or may be caused by said taking or by said possession, use, control or operation."

The owners' committee, relying upon express language of the act itself, is clearly within its legal rights to refuse to accept such a "blind blanket warrant of release," and no board of directors, trustees, receiver or agent would be faithful to his trust to accept such a claim which would absolutely surrender the rights guaranteed by law and the very act itself.

The act expressly provides that "the President is authorized to enter into an agreement with such carrier for just compensation upon a basis not in excess of that reported by board (of referees) and may include therein provisions similar to those authorized under Section one.

"Failing such agreement, either the United States or such carrier may file a petition in the Court of

Claims for the purpose of determining the amount of such just compensation, and in the proceedings in said court the report of said referees shall be *prima facie* evidence of the amount of just compensation and the facts therein stated."

The release clause exacted by the lawyers of the railroad administration nullifies the act itself and should be eliminated, and in its stead a modern arbitration clause inserted which would be eminently fair and just to both parties.

2. Granting to the Director General of Railways the right to make such additions and betterments, purchase new equipment, build new terminals and extension of road as in his uncontrolled discretion may be necessary, and charge the same to capital expenditure without the approval of the board of directors of the carrier and regardless of whether such improvements are necessary to handle current traffic or are required for war purposes.

Plain Intent of the Act

The act specifically provides that the President may also order any carrier to "make any additions, betterments or road extensions, and to provide terminals, motive power, cars and other equipment necessary or desirable for war purposes, or in the public interest, or in connection with the property of any carrier. He may from said revolving fund advance to such carrier all or any part of the expense of such additions, betterments or road extensions, and provide terminals, motive power and any other necessary equipment so ordered and constructed by such carrier or by the President, such advances to be charged against such carrier and to bear interest at such rate and be payable on such items as may be determined by the President, to the end that the United States may be fully reimbursed for any sum so advanced.

"Any loss claimed by any carrier by reason of any such addition, betterments or road extensions so ordered and constructed may be determined by agreement between the President and such carrier; failing in such agreement the amount of such loss shall be ascertained as provided in Section 3 hereof."

It is plainly the intent of the act that the cost of any additions, betterments or improvements which are not needed by the carrier shall be borne by the Government. Provision should therefore be made in the contract that all additions, betterments, extensions of roads, terminals, equipment, etc., before being made shall be submitted to the board of directors of the carrier for approval or disapproval, and that, upon failure to agree on their necessity, the questions at issue should be submitted to arbitration, and any redress for loss to the carrier adjudicated by the Court of Claims, all as provided in the act.

3. The agreement does not protect the carrier in the payment of fixed charges paid during the test period.

The draft agreement provides that the cost of excess-maintenance which the Director General may incur at his discretion on the property of the carrier must be first deducted from the standard return, although in some instances it may result in the carrier defaulting in the payment of fixed charges.

One of the principal reasons given for Federal control of railways was the stabilizing of the financial interests of the carriers and assuring that the fixed charges would be paid. The effect of the clause cited will defeat this very purpose and discredit the stability of railway securities.

The situation may be illustrated from everyday life. If one were the owner of a dwelling and a tenant were to draw up the lease and insert a clause that any expense for maintenance which he might choose to make should first be deducted before payment of rental, the owner might naturally object and be concerned as to his ability to pay taxes, insurance and interest on mortgage, to say nothing of interest on the investment. The case is precisely a parallel to the one the carriers now face.

The question of the maintenance of the property of the carrier is one that should be settled between the parties to the contract after considering the experience of the test period. In case of nonagreement the question should be submitted to arbitration in the usual manner.

4. The provision of the draft agreement, that all disputed questions as to upkeep of the carriers' property shall be referred to the Interstate Commerce Commission, whose decision shall be final except as to questions of law, is not acceptable to the owners' committee for the reason that it leaves the broad question of fact, which is the main one in matters of upkeep, absolutely in the hands of the Interstate Commerce Commission, and without giving the carriers any redress by appeal to the courts, which the act itself specifically contemplates.

Mutuality of Contract Lacking

The position taken by the carriers that such disputed questions should be subject to review by the United States Circuit Courts of Appeal is eminently fair and reasonable and will be concurred in by all fair-minded men.

5. No assurance is provided that dividends heretofore paid will continue to be paid until after deducting the amounts necessary to reimburse the Government for all additions and betterments (except road extensions and additions and betterments made solely for war purposes.) There is absolutely no mutuality in this clause of the contract. It leaves the carrier at the mercy of the Director General, who is the sole judge as to the necessity of any improvement in the carrier's property. In order to be eminently fair to both parties and establish proper mutuality of contract, all matters of improvement should be submitted to the board of directors of the carrier for approval or disapproval before being carried into effect. Any disagreements should be submitted to arbitration in the usual manner.

6. No restriction whatever is placed upon the extent to which the Director General may make or order the carrier to make additions, betterments, etc., for war purposes or otherwise, whether the carrier requires them or not, and charge the same to the carrier. The only redress which is left to the carrier is to claim a loss in a litigation against the Government, with the burden of proof on the carrier. This is eminently unfair to the carrier and is altogether one-sided, lacking entirely the element of mutuality. No corporation

charged with the trust of safeguarding its interests in law and in equity could willingly subscribe to such an arrangement, and the act itself does not require the carrier thus to waive its rights under the law.

7. The draft contract does not fix definitely the rate of interest to be charged the carrier on the costs of additions, betterments, road extensions, etc., but places the matter wholly within the power and discretion of the Director General, which may subject the carrier's return to ever-varying deductions and further reduce the amount available out of the standard return to pay its fixed charges and other expenses.

Let it be supposed that the Director General orders an improvement costing $10,000 to be made by the carrier, which may result in a saving in operation of 30% per annum. It is not fair that the carrier should be obliged to pay the Government 5% or 6% interest on this investment and have its standard return reduced by that much while the Government obtains the increased return in its operation and the carrier derives absolutely no benefit therefrom. It is only fair that in such cases the Government and the carrier should equally share in the benefit of such expenditure during Federal control. It is all the more important that all matters regarding additions, betterments, etc., which are charged to capital account, should first have the approval of the carrier in order to safeguard the public against extravagance and waste in expenditures which are unnecessary and not justified.

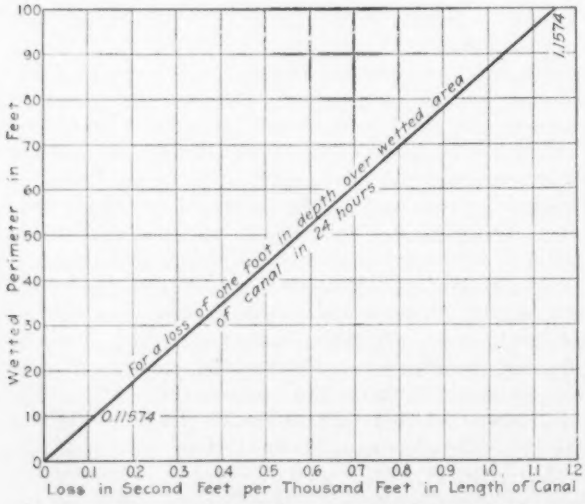
Who is better able to judge the necessity and wisdom of an expenditure chargeable to the property? The owner who must carry the burden or the transient tenant who has no interest in the property and no financial responsibility? It is against all law and the rights of property to depart from business principles in this manner, as proposed by the lawyers who drew the tentative contract.

It is of the utmost importance in the interests of the stability of the financial status of the railways directly and the country at large that an equitable contract be concluded with the railways at an early date, as the railways generally are wholly at sea as to any definite policies or future course. Interests involving some eighteen to twenty billions of dollars are absolutely marking time until this important question of contract is settled.

Transforming Canal Losses in Terms of Depth to Quantity

By Percy A. Cupper
Assistant State Engineer, Salem, Ore.

THE practice which prevailed a few years ago of estimating seepage losses in canals in per cent. of water carried has given way to the more accurate method of estimating the loss in depth over the wetted area of the canal. This method is based on the assumption that the seepage loss will vary directly with the wetted area of the canal, which in turn varies with the wetted perimeter. It will be observed that the seepage loss is therefore independent of the quantity of water carried by the canal. The loss of water over the wetted canal area in a given time will vary with the character of the bed of the canal but will probably fall between 0.1 ft. in depth for concrete lined canals to 2 ft. in depth for canals in loose material in a period of 24 hours. However, what the designing enginerr wishes to know is how much the canal will lose in cubic feet per second and probably the most convenient and practical diagram or tabulation is one showing loss in second feet per thousand feet length of canal for any given wetted perimeter.



SEEPAGE LOSS IN IRRIGATION CANAL TRANSFORMED FROM DEPTH TO SECOND-FEET

The accompanying simple diagram gives this information for wetted perimeters from 0 to 100 ft. for a loss of 1 ft. in depth over the wetted canal area in 24 hours. The points on the curve were obtained by multiplying the wetted perimeter in feet by 1000 and dividing by 86,400. Should the loss be estimated at 2 ft. in depth in 24 hours, the number of second-feet shown in the diagram should of course be doubled. Likewise, if the loss be 0.1 ft. in depth in 24 hours, the result shown in the diagram should be divided by ten, and so on for any estimated seepage loss.

It is believed that the use of such a diagram will not only prove a time saver but will also have a tendency to cause more attention to be paid to the probable seepage losses in the design of a canal.

City May Adopt Municipal War Program

Curtailment of municipal improvements at Minneapolis to meet war conditions is reported by F. W. Cappelen, city engineer. Only some nine miles of sewers and ten miles of water mains are being laid this year, compared with twice that amount normally. Paving has been cut down in like manner. The water-filtration plant is being extended, this being considered a necessity and money for the work being available. Minneapolis is working under a budget system. Next year's budget will be taken up by the Board of Tax Levies in August and later on by council committees, and then by the City Council. Mr. Cappelen expresses the hope that a municipal war program will be adopted in connection with the budget for 1919.

Fully Metered Plant Treats Highly Turbid Arkansas for Tulsa

Venturi Meters of New Type Supply and Control Dry Chemical Feeders—Weighted Swing Gates Equalize Resistance in Mixers

FOR treatment of the unusually turbid Arkansas River water at Tulsa, Okla., a rapid filter of 8,000,000-gal. daily capacity has recently been put into operation, to serve a population growing so fast on account of the oil-well developments as to make entirely unreliable the census figures taken a year ago. Best estimates, however, place the number of consumers at eighty thousand.

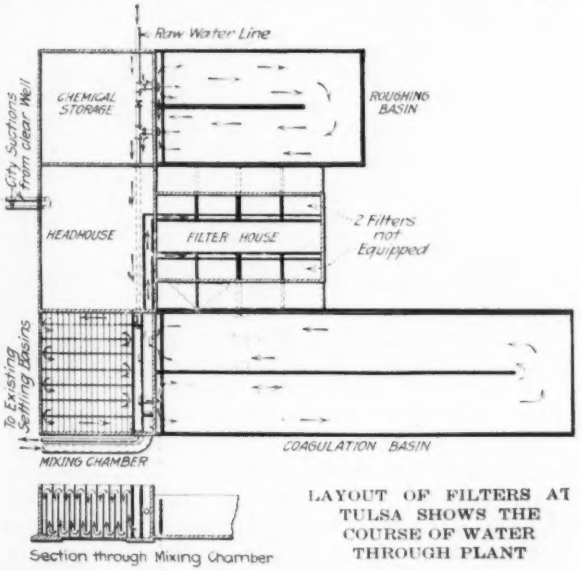
Salient features compelling attention in this plant are a new type of venturi meter with a short curved approach and recovery or modified vena contracta, dry-feed chemical machines controlled by this meter, a mixing chamber with up-and-down baffles and weighted swing gates on the under baffles to equalize the resistance causing loss of head under changing velocities, and meters of the same equal-pressure diaphragm type controlling the filter to meet the varying consumption.

As a source of supply, the Arkansas River at this point is exceeded in difficulty of treatment, for hardness as well as turbidity, by few other Southwestern rivers. Somewhat polluted by sewage and at each rise by a large quantity of waste from oil refineries and wells, the construction of the old intake, far from the main channel, at the end of a canal destroyed by each flood, is such as to skim much of this floating material and improve the average condition of the water flowing in the principal thread of the stream. Until a new intake can be built, the plant must handle the worst rather than the best water flowing in the river. As much as 4000 parts per million of sodium chloride, 265 of sulphates of lime and magnesia, and turbidities of 18,000, have been observed since the laboratory at the plant has been started. Bacilli coli are found in all c.c. river samples and total bacteria counts of 20,000 per c.c. at 37½° C. are not uncommon.

Situated near the existing pumping station, which formerly drew its supply from wells on the river bank, the new plant is fed by two centrifugal pumps, one of 4,000,000-gal. and one 8,000,000-gal. capacity, lifting the water 17 ft. to the roughing basins for two-hour storage. Thence it passes, as shown in the sketch, to the mixers for one hour and the coagulation basin for 11¼ hours. Following the filtration, two hours' storage is provided under the filters, from which the existing high-pressure pumps take their supply and discharge it into the city mains.

All the water entering the purification plant passes by a 30-in. pipe to an equal-pressure diaphragm meter, which has an approach 30 in. long, a throat 10 in. in diameter, and a total tube length slightly more than 50% of a standard tube. The pressure recovery is found to be a trifle better than that given by a standard tube.

Four multiple drillings of unusually large area connect the annular pressure chambers, around the approach and the throat, to the stream. The approach chamber is connected by an open pipe line to the bottom of a diaphragm situated so as to cause the approach pressure always to act on the diaphragm. Immediately adjacent to the throat pressure chamber is installed a standard orifice of small diameter, with its discharge side looking toward the throat. The throat pressure is always acting on the discharge side of this orifice. The approach side of the orifice, which is fed from a source of higher pressure, is connected to the discharge side of the valve of the diaphragm and always feels the pressure created by the valve, on the top of the diaphragm. This is always maintained just equal to the pressure on the bottom of the diaphragm, which is the pressure on the approach of the tube. Under

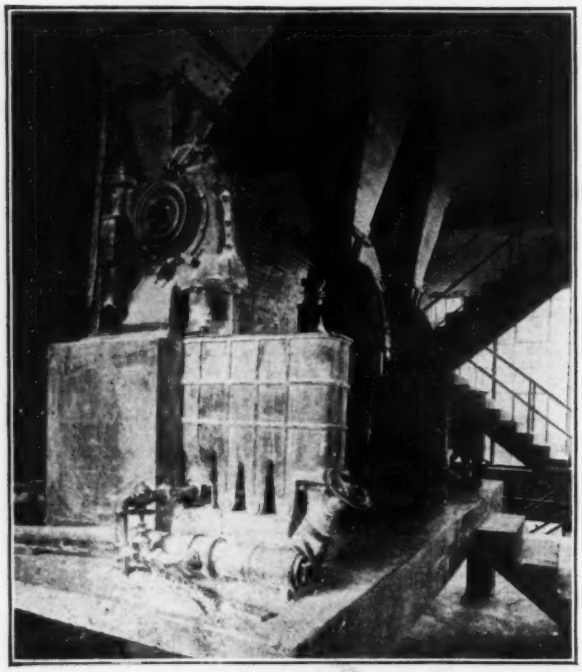


LAYOUT OF FILTERS AT TULSA SHOWS THE COURSE OF WATER THROUGH PLANT

these conditions, the flow through the small standard orifice and into the throat of the tube must always be proportional to the flow through the tube, and, therefore, if the small flow through the orifice be metered, the large flow through the large tube will also be metered. The gear train of a small meter is made to drive a pen which traces an ink record on a chart on a clock-driven drum. A cam forces the pen to rise to its high point, when it is released and instantly falls by gravity to its low point. Each rise and fall of the pen cuts a saw-toothed curve, the angle of the up-stroke being dependent on the volume of flow through the small meter.

Each saw-toothed curve represents a definite volume of flow through the small meter, and also a definite volume of flow, 100,000 gal., through the pressure-difference tube. The chart, of the seven-day type, has 10 subdivisions. This permits reading to within a 5000-gal. total of flow for any time period. The small metered flow is made to pass a small orifice. A mercury manometer, which feels the pressure on the two sides of this orifice, indicates the rate of flow at any moment and, reading against a graduated scale, indicates the total flow. Water entering the plant is thus metered by an integrating meter, indicated by a manometer and recorded on a self-planimetering chart.

Control of the three dry-feed machines for supplying sulphate of iron, lime and soda ash may be manual



DRY-FEED MACHINES ARE CONTROLLED BY WATER ENTERING THE PLANT

at a fixed rate or act automatically in proportion to the flow of water into the plant.

The small flow to the disk meter of the metering device is derived from a high-pressure main of ample capacity. It is first made to pass a small master standard orifice. The difference of pressure on the two sides of this orifice is functional to the flow through the orifice, and as this flow is the flow into the throat of the equal-pressure diaphragm meter, it is also functional to the flow of water into the plant.

Each chemical machine is provided with an individual orifice. The pressure on the approach of each of these is the same as that acting on the approach of the master orifice. Each chemical machine is also provided with a diaphragm which controls a valve. The pressure on the bottom of the diaphragm of all the chemical machines is the pressure also acting on the discharge side of the master orifice. The pressure on the top of the diaphragm is that created by its valve, and as the pressure on the bottom of all the diaphragms is the pressure acting on the discharge side of the master orifice, while the pressure acting on top is the pressure acting on the discharge side of the individual orifice, we have all the orifices, both master and individual, with equal pressures on their discharge sides and equal pressures on their approaches. Hence, the discharge through both the master and the individual orifices must be proportional to their area.

The flow through the individual orifice is made to actuate the motor of a chemical machine. This motor is of the reciprocating type, and the piston stroke and area are the same for all. With an equal volume of flow through each motor, therefore, the speed of the motors will be equal. With the arrangement above described, it will be seen that as the flow through the master orifice is functional to the flow of water into the plant, and as it is also functional to the speed of the motors of each chemical machine, the machines move or stroke functionally to the flow of water into the plant.

The chemical machine consists of a wheel, having a milled surface, which is driven past an orifice. A ratchet wheel, set on the same shaft, drives the wheel forward past the orifice. The ratchet wheel has 48 teeth, with an adjustable guard so one or more teeth can be engaged. Each stroke of the motor can be made to throw from one to 12 teeth on the stroke. Thus each stroke can be made to cause from $\frac{1}{48}$ to $\frac{1}{4}$ of a revolution of the milled wheel. This amounts to a peripheral movement of from 0.78 in. to 9.4 in. The height of the orifice can be varied between zero and $1\frac{3}{4}$ in. and from $\frac{1}{8}$ to 3 in. in width. The minimum practical dosage is about 0.25 cu.in. of dry material per stroke of machine, while the maximum is about 50 cu.in., a variation of from 1 to 200. Above the chemical machine is a hopper, of inverted-pyramidal shape, holding a day's supply. From this the chemical wheel takes its supply of dry chemical through the adjustable orifice.

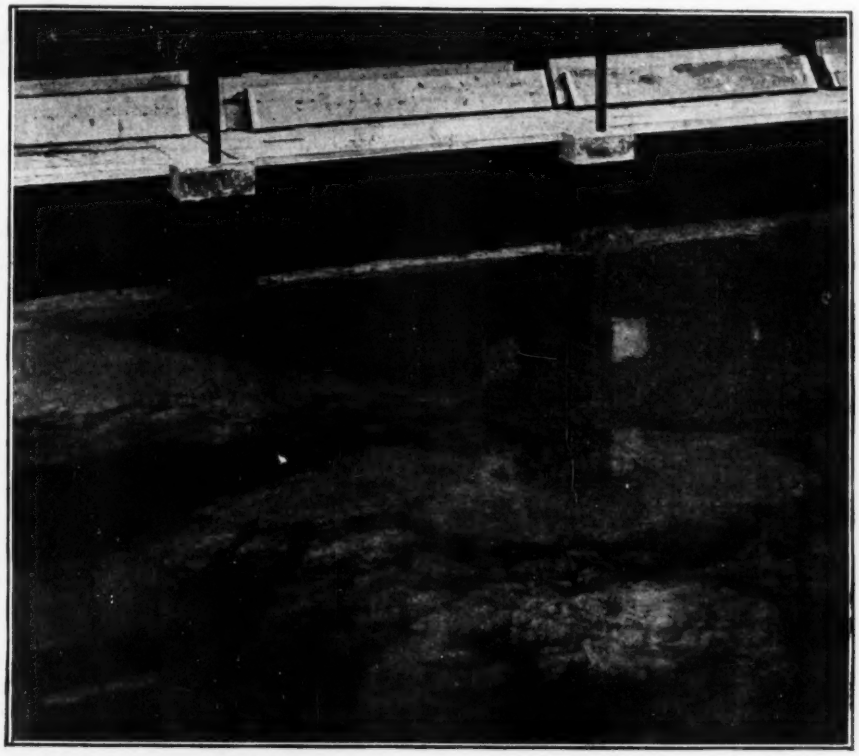
The water discharge from the motor and the dry chemical from the wheel are brought together in a small chamber, which can also be supplied with a secondary water flow to dissolve or carry away the chemical to the point of application. Each up baffle in the mixing chamber extends to the bottom of the mixing chamber and is provided with a swinging gate, kept closed in normal operation by a concrete weight fastened to it in such manner as to hold it closed except

MIXING CHAMBER PROVIDED WITH AMPLE BAFFLE SLOTS FOR VARIATIONS

when the basin is being drained or filled. Each down baffle extends above the water line and is raised or clear of the bottom for $6\frac{1}{2}$ in. Above this is another swing gate intended to hang vertically when low flows are in use, and to swing out in the direction of flow with larger flows, thus affording a larger cross-section and reduced resistance over what would obtain with a fixed-bottom clearance. The purpose was to maintain about the same resistance and loss of head through the mixing chamber on all volumes of flow through it.

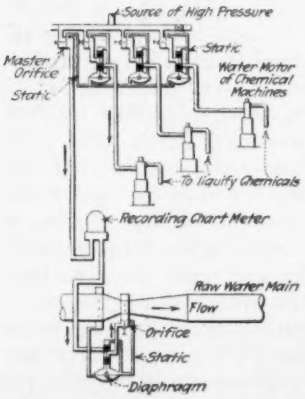
The calculated loss of head at the time the gates were weighted and baffles extended was within 3 in. of the observed loss of head after the baffles were changed. At a 4,000,000-gal. rate, the calculated loss was 42 in. and the actual loss 39 in. Variations of from 1,750,000

to 7,000,000-gal. rates have been handled with no difficulty by this mixing chamber, in its present arrangement. While the weighting of the gates is approximately correct for high rates, it is realized that, with the data now available, a better arrangement of the weighting can be effected and a closer control can be obtained of the velocities at the under-turn at low rates. The mixing chamber is 50 x 49 ft. and 20 ft. deep. The up-and-down mean velocity is about 0.7 ft. per second, and the velocity at the under-turn is approximately 2 ft. per second. The results that are obtained from the use of this mixing chamber are all that were expected or could be desired. Samples taken at various points through the mixing chamber under varying conditions of raw water, chemical treatment and volume of flow have shown a consistently improving quality of coagulation up to the point of discharge into the settling basins. Regardless of the type or quantity of the turbidity, the coagulation has been uniformly satisfactory, and when the water has entered the settling basins precipitation has been rapid and complete. The view shows this action very clearly. At the lower edge, a little to the left of center, the lens worked through from 3 to 4 ft. of clear water.



LIGHT CLOUDY PORTION IS COAGULANT QUICKLY CLEARING TO DARK PORTION

Each filter is equipped with a combined meter and controller similar in principle to the main supply meter, except that it is of straight-line design. The eight filters have each 357 sq.ft. of sand area, and the rates can be controlled from zero to 175,000,000 gal. per acre per day. One of the innovations of this plant is a master meter which measures the composite flow of all the filters and makes a saw-tooth record on a chart, indicating 100,000 gal. per tooth. In addition to fixed- and variable-rate controllers is a master controller which is responsive to the level of the water in the clear well. The plant has been in service only a short time and the data so far available are rather scanty and not as reliable as they will be when all the possible seasonal variations shall have been encountered. The hardness of the raw water has been as high as 380 parts per million and was reduced to 44 parts per million. Bacterial reductions amount to about 98%, obtained without the use of chlorine. There is a virtual absence of bacilli coli in the filtered water. The plant is equipped, however, with dry chlorine apparatus. The percentage of wash water does not exceed 0.7% and will probably average less than 0.5%. The filtered water is free from color and brilliantly clear and sparkling.



PROPORTIONAL FLOW METER AND REGULATOR

The cost of the plant to date has been approximately $200,000. It was built during the term of office of C. S. Younkman, water commissioner, by the Fogel Construction Co., Kansas City, Mo., general contractors, and the equipment was furnished by the Pittsburgh Filter Manufacturing Co. The consulting engineers were Stevens & Stiles, Kansas City, and C. Arthur Brown acted as supervisory engineer for the city on the plans and specifications. The plant is in charge of W. R. Holway, superintendent of filtration.

Women Employed as Tar Sprayers in England

Women have been employed, for some time past to spray tar upon the highways of Westminster, England, according to a report in the London *Surveyor*. J. W. Dugdale-Bradley, city engineer, reports that, generally speaking, their work has been quite satisfactory. They work 50 hours per week, and the rate of wages in American money is 26c. per hour, rising to 30c. per hour on satisfactory service. Women who manipulate brushes for spraying tar receive an additional 4c. per hour. They wear uniforms, consisting of clogs, caps and gloves, which are supplied by the city. Portable mess rooms and lavatories are also provided for the women workers.

Highway Carries Twelve Times as Much Local Freight as Railroad

Shipments by Baltimore Road Increase 480% in Year, Saving Railways 39.923 Ton-Miles—Pennsylvania Road Shows Considerable Gain in Time of Shipment Over Railway

THAT twelve times as much freight was carried by motor trucks over the highway between Baltimore and Belair, Md., as was carried in the same period by the parallel railroad, is shown by a census of the Maryland State Roads Commission for the year that ended May 31 last. The motor-truck freight traffic increased 480% in this period, and the average gross tonnage carried was 2644 per 12-hour day. The average number of vehicles using the road exceeded 1000 per 12-hour day. Another traffic census of the Lincoln Highway, between Chambersburg and Bedford, Pa., taken by the Pennsylvania Highway Department, shows an actual saving of 39,923 ton-miles a day.

The first census, shown in one of the tables, covers a stretch of road 14 miles long from Baltimore to Belair. Two miles are paved with tar macadam, six miles with bituminous macadam on a concrete base, and six miles with oiled waterbound macadam. The road is standing up well under the heavy traffic, but constant maintenance is required to keep it in condition.

Farmers' Association Uses Road

A considerable amount of the increase in traffic during the early part of this year was caused by the use of the road by the trucks of the Harford County Farmers' Coöperative Association. This association holds the state franchise for operating a motor express line over this road, in accordance with a recent law enacted by the state Legislature. Stations are established at various points to collect milk and other produce of the farms, which the trucks pick up and transport to the city, returning with the empty milk cans, merchandise, materials and implements needed by the patrons. This association started one of the first motor express routes, which is said to have been very successful.

The period included in the table covers the year which ended May 31, 1918. According to its custom, the roads commission had observations taken one day each month, being careful to use a different day of the week in each succeeding month. It was thought that by this method a general average would be obtained for the entire year. The hours of observation were from 7 a.m. to 7 p.m. The data collected were complete, including every kind of vehicle which uses the road from a one-horse cart to a 5-ton motor truck.

How Tabulation Was Done

The gross weight in tons, shown in the second column of the table, was determined by weighing a large number of vehicles as they passed over the roads. When a sufficient number of weights of all types of conveyances to give a fair average had been collected, they were separated into the various classes and a standard weight was determined for each class. The dead weights of the various makes of automobiles and trucks were also compiled, and it was found that the average live-load for each class was practically one-half the gross weight. Thus, one-half of any tonnage figure shown in the census table should be the actual amount of freight represented by that item. The tonnage for each class of traffic is summed up in the table, and the grand totals of each day and for the 12 days are shown. In the last two lines, the monthly and yearly tonnage of both the highway and the railroad are tabulated. The monthly highway tonnage was computed on the assumption that there are 26 working days per month. The monthly motor truck tonnage is that of the four classes of trucks only; no account being taken of horse-drawn or passenger vehicles. The railroad tonnage was taken from the forwarding sheets of the company and includes all shipments forwarded from Baltimore to Belair and vice versa. Considerable of the railroad freight did not originate at the forwarding points, but was in carload lots to and from foreign roads. The railroad figures for May could not be ascertained, and they were supplied by using the figures for August, the largest previous month.

Referring to the tabulation, it will be seen that the net tonnage of the four classes of motor trucks was 213,564 for the year. This is the sum of the total gross tons transported per day, divided by 2 and multiplied by 12 and 26, according to the assumption mentioned above. The actual amount of freight carried by the railroad for the year was 17,568 tons. On the average, as much freight was carried over the highway in one month as the railroad carried in a whole year. This, of course, refers only to local business between the two points.

War Traffic Over Highway

The increase in strictly freight tonnage during the year as compared with the total tonnage is very marked. The total amount of tonnage June 1, 1917, for all vehicles was 1926, while the amount for May 14, 1918, was 4801 tons, or an increase of 149%. The gross total of strictly freight traffic increased from 524 tons to 3030 tons, a gain of 480%. Beside the local traffic, this road has served as a route for a large number of United States Army motor trucks, going through loaded with quartermaster supplies and truck parts on their way from the factories to the battlefields in France.

The total number of vehicles using the road on the 12 days of observation was 12,865 or 1072 per day. Of these, 1290 were horse-drawn, gross weight 1965 tons, 7530 were passenger auto traffic, gross weight 11,786 tons, and 4045 were motor-truck and motor-bus traffic, gross weight 17,980 tons. The total tonnage for the 12 days was 31,731, or 2644 tons per day. This shows what a small part the horse plays on the modern highway, hauling little over 6% of the loads. Taking 27.1 tons as the average load per freight car,

TRAFFIC CENSUS OF BALTIMORE-BELAIR HIGHWAY FOR THE YEAR ENDING MAY 21, AND THE RAILROAD TONNAGE, PER MONTH, FOR THE SAME PERIOD

Description	Gross Weight in Tons	June 2, 1917 No.	June 2, 1917 Tons	July 1, 1917 No.	July 1, 1917 Tons	Aug. 2, 1917 No.	Aug. 2, 1917 Tons	Sept. 17, 1917 No.	Sept. 17, 1917 Tons	Oct. 1, 1917 No.	Oct. 1, 1917 Tons	Nov. 1, 1917 No.	Nov. 1, 1917 Tons	Dec. 1, 1917 No.	Dec. 1, 1917 Tons	Jan. 26, 1918 No.	Jan. 26, 1918 Tons	Feb. 7, 1918 No.	Feb. 7, 1918 Tons	Mar. 2, 1918 No.	Mar. 2, 1918 Tons	Apr. 21, 1918 No.	Apr. 21, 1918 Tons	May 14, 1918 No.	May 14, 1918 Tons	Total No.	Total Tons
One Horse: Runabouts, open and top buggies	0.362	12	4.3	13	4.7	15	5.4	15	5.4	18	6.5	28	10.1	17	6.2	15	5.4	11	4.0	47	17.0	23	8.3	28	10.1	242	87.4
One Horse: Open spring wagons and covered delivery wagons	1.00	20	20.0	3	3.0	19	19.0	21	21.0	11	11.0	11	11.0	12	12.0	44	44.0	78	78.0	96	96.0	87	87.0	45	45.0	447	447.0
Two Horse: Family carriages and hacks	0.562	7	3.9	.....	.....	3	1.7	.....	.....	4	2.2	8	4.5	7	3.9	.....	.....	27	15.1	30	16.9	8	4.5	.....	.....	94	52.7
Two Horse: Delivery wagons, vans, farm wagons and dump wagons	2.50	10	25.0	.....	.....	6	15.0	7	17.5	23	57.5	.....	.....	5	12.5	49	122.5	77	192.5	63	157.5	78	195.0	89	222.5	407	1,017.5
Three Horse: Farm wagons, drays and vans	3.50	5	17.5	.....	.....	4	14.0	.....	.....	.....	.....	.....	.....	.....	.....	2	7.0	14	49.0	17	59.5	7	24.5	9	31.5	58	203.0
Four Horse: Farm wagons and vans	3.75	8	30.0	.....	.....	2	7.5	.....	.....	.....	.....	.....	.....	2	7.5	10	37.5	9	33.8	4	15.0	.....	.....	7	26.2	42	157.5
Horse-drawn totals	.....	62	100.7	16	7.7	49	62.6	43	43.9	56	77.2	47	25.6	43	42.1	120	216.4	216	372.4	257	361.9	203	319.3	178	335.3	1,290	1,965.1
Motorcycles	0.225	20	4.5	140	31.5	31	7.0	42	9.4	25	5.6	15	3.4	22	5.0	2	0.5	3	0.7	38	8.6	36	8.1	31	7.0	405	91.3
2 Passenger Automobiles: Light-weight machines	0.900	70	63.0	55	49.5	39	35.1	57	51.3	60	54.0	32	28.8	28	25.2	10	9.0	26	23.4	40	36.0	63	56.7	30	27.0	510	459.0
2 Passenger Automobiles: Machines of medium and heavy weight	1.75	55	96.2	50	87.5	30	52.5	50	87.5	48	84.0	25	43.8	30	52.5	28	49.0	58	101.5	82	143.5	78	136.5	57	99.8	591	1,034.3
5 Passenger Automobiles: Light-weight machines	1.125	180	202.5	595	669.4	145	163.1	275	309.4	180	202.5	185	208.1	150	168.8	127	142.9	104	117.0	234	263.2	357	401.6	335	376.9	2,867	3,225.4
5 and 7 Passenger Automobiles: Medium and heavy weight machines	2.25	195	438.8	510	1,147.5	108	243.0	291	654.8	145	326.2	200	450.0	162	364.5	110	247.5	127	285.8	215	483.8	268	603.0	316	711.0	2,647	5,955.9
3 and 4 Passenger Enclosed Automobiles: Like taxi-cabs	2.00	100	200.0	104	208.0	130	260.0	22	44.0	27	54.0	58	116.0	27	54.0	.....	.....	.....	.....	4	8.0	.....	.....	38	76.0	510	1,020.0
Passenger vehicle totals	.....	620	1,005.0	1,454	2,193.4	483	760.7	737	1,156.4	485	726.3	515	850.1	419	670.0	277	448.9	318	528.4	613	943.1	802	1,205.9	807	1,297.7	7,530	11,785.9
Store Delivery Automobiles: Light weight machines with tops	1.125	40	0	.....	.....	30	33.8	38	42.8	60	67.5	60	67.5	40	45.0	10	11.2	22	24.8	18	20.2	29	32.6	18	20.2	365	410.6
Store Delivery Automobiles: Medium and heavy-weight machines with tops	2.25	20	45.0	.....	.....	18	40.5	6	13.5	12	27.0	11	24.8	6	13.5	22	49.5	28	63.0	30	67.5	38	85.5	23	51.8	214	481.6
½-, 1, 1½- and 2-ton Hauling Trucks	3.20	30	96.0	.....	.....	20	64.0	12	38.4	23	73.6	13	41.6	15	48.0	121	387.2	149	476.8	204	652.8	240	768.0	282	902.4	1,109	3,548.8
3-, 4- and 5-ton Hauling Trucks: Heavy vans, freight and stone trucks	7.50	45	337.5	22	165.0	55	412.5	103	772.5	85	637.5	94	705.0	115	862.5	133	997.5	133	997.5	268	2,010.0	273	2,047.5	274	2,055.0	1,600	12,000.0
Passenger Auto Busses: Light-weight machines	1.15	102	117.3	95	109.3	65	74.8	75	86.2	60	69.0	60	69.0	.....	.....	.....	.....	7	8.0	.....	.....	.....	.....	2	2.3	466	535.9
Passenger Auto Busses: Machines of medium weight	3.00	23	69.0	32	96.0	16	48.0	10	30.0	16	48.0	5	15.0	31	93.0	14	42.0	16	48.0	.....	.....	4	12.0	20	60.0	187	561.0
Passenger Auto uses: Heavy machines	4.25	26	110.5	12	51.0	6	25.5	15	63.8	.....	.....	15	63.8	.....	.....	12	51.0	.....	.....	.....	.....	.....	.....	18	76.5	104	442.1
Freight vehicle totals	.....	286	820.3	161	421.3	210	699.1	259	1,047.2	256	922.6	258	986.7	207	1,062.0	312	1,538.4	355	1,618.1	520	2,750.5	584	2,945.6	637	3,168.2	4,045	17,980.0
Grand totals	.....	968	1,926.0	1,631	2,622.4	742	1,522.4	1,039	2,247.5	797	1,726.1	820	1,862.4	669	1,774.1	709	2,203.7	889	2,518.9	1,390	4,055.5	1,589	4,470.8	1,622	4,801.2	12,865	31,731.0
Net tonnage of trucks per month and year	.....		6,786		2,132		7,150		11,258		10,452		10,894		12,584		18,772		20,306		35,750		38,116		39,364		213,564
Actual tonnage by railroad per month and year	.....		1,885		1,481		2,246		1,874		1,884		1,199		979		593		794		1,086		1,301		2,246		17,568

213,564 net tons would be equivalent to 7880 carloads of freight, which transportation capacity can now be utilized to help overcome th shortage in freight-handling facilities.

The census on the Lincoln Highway, which is also tabulated, shows how a highway is aiding in the solution of the transportation problem by eliminating the long haul. The record was taken by the Pennsylvania State Highway Department. The distance between Chambersburg and Bedford is 57 miles, while the shortest railroad route is 140 miles. In computing the tonnages, it was assumed that the east-bound traffic was all loaded while the west-bound traffic was one-half loaded. Only the motor trucks were considered as carrying through loads, and the total through freight per day was found to be 481 tons. As the number of miles by highway is 57, the number of ton-miles would be 27,417. In the same manner, the railroad ton-miles would be 67,340 and the saving by the highway route would be 39,923 ton-miles.

TRAFFIC CENSUS OF CHAMBERSBURG-BEDFORD HIGHWAY TAKEN MARCH 22, 1918

Description	Direction of Traffic—Eastward No.	Eastward Tons	Westward No.	Westward Tons	Totals No.	Totals Tons
Horsedrawn:						
One horse	55	0	60	0	115	0
Two horse	19	30	17	10	36	40
Three and four horse	1	2	1	1	2	3
Automobiles:						
Roadsters	33	0	17	0	50	0
Touring cars	159	0	76	0	235	0
Motor Trucks:						
1-3 ton	51	153	19	30	70	183
5-6 ton	20	100	0	0	20	100
U. S. 3 ton	66	198	0	0	66	198
Motorcycles	3	0	3	0	6	0
Totals	407	483	193	41	600	524
Through tonnage						481

The census was taken under the direction of Frank H. Zouck, chairman, and J. N. Mackall, chief engineer of the State Roads Commission, and George H. Biles is acting chief engineer of the Pennsylvania State Highway Department, which made the second tabulation.

Impervious Bituminous Wall Suggested To Prevent Seepage Under Paving

Extensive Study Made of Vertical Movements of Pavements with Reference to Frost Action—Distribution of Moisture in Clay and Loam Subgrades and Effect of Walling Off Shown by Charts

PLACING an impervious wall made of sheets of bituminous material $\frac{3}{8}$-in. thick and extending from top of curb to 4 ft. below the bottom of the concrete base, is the novel suggestion made for controlling the water content under pavements. The suggestion was made in a paper presented before the recent convention of the American Concrete Institute, by John W. Lowell, division engineer of the Universal Portland Cement Co. The paper describes a study of the vertical movements of pavements, and the relation of frost action to longitudinal cracking, and was based upon an investigation of Sheridan Road, Kenilworth, Ill., extending over a period of one year. During the period of study, 12,528 level readings were taken on 3325 lin.ft. of concrete pavement. All deflections over $\frac{7}{16}$ in. were found to cause cracks, while those under $\frac{11}{32}$ in. caused no cracks. An abstract of the paper follows.

Date of Reading	REL. MOVEMENT AT NORTH JOINT—MM. W	C	E	DEFL.	Diagram of Cracks N.	S.	DESCRIPTION OF SUBGRADE	REL. MOVEMENT AT SOUTH JOINT—MM. W	C	E	DEFL.
SLAB NO. 18											
Jan. 5-6	12	10	14	-3			Clay with small Percentage of Fine Sandy Loam	14	7	11	-5.5
Feb. 27-28	33	20	36	-15.5				29	17	21	-8
Mar. 16-17	27	18	28	-9.5			E. Half spongy and soft, W. half compact and rough	21	11	13	-6
May 4-5	-2	2	1	2.5				1	0	-1	0
June 8	-3	1	0	2.5			When hard, dry Surface and wet below	-1	-1	-2	0.5
July 26	-3	1	-2	3.5				-1	-1	-3	1
Oct. 25-26	-6	0	-6	6			100 Days Old before freezing	-5	-1	-9	6
SLAB NO. 86											
Jan. 5-6	4	6	13	-2.5			2' of Old Macadam spread and tamped, clean Sand below for more than 3 Feet	9	11	5	4
Feb. 27-28	14	13	25	-0.5				11	29	28	6
Mar. 16-17	12	18	24	0				19	27	26	4.5
May 4-5	1	0	1	-1				2	2	2	0
June 8	2	1	1	-0.5				2	2	2	0
July 26	2	0	1	-1.5			Dry when laid	2	2	2	0
Oct. 25-26	2	0	0	-1			49 Days Old before freezing	1	1	-1	1

Zero Reading Oct. 27-28, 1916

VERTICAL MOVEMENT OF TYPICAL SLABS, ITS EFFECT, AND NATURE OF SUBGRADE COMPILED

What it is worth to the public to eliminate cracks depends largely upon their objection to them. To the engineer a problem in economy is presented which may have as many solutions as there are engineers. These solutions must be based largely on assumptions, as no exact knowledge is available.

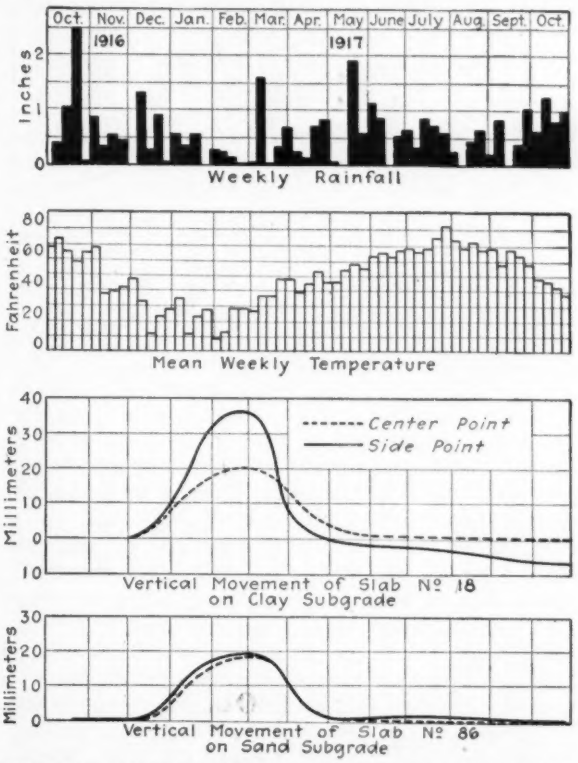
Before starting to eliminate cracks, it is pertinent to know the extent to which they exist and their cause. In climates where freezing occurs, it has been found from general observation of pavement slabs less than 60 ft. in length, that the following is true: (1) Transverse cracks do not occur as frequently as longitudinal cracks; (2) for width over 18 ft., frequency of longitudinal cracks is apparently unaffected by width of pavement; (3) cracks seldom occur in pavements lying on sand or well-drained porous subgrades; (4) on clay or heavy loam soils longitudinal cracks are of frequent occurrence; (5) the more compact the subgrade soil, the more frequently cracks occur; (6) cracking of pavements on clay or heavy loam soils cannot be entirely prevented by artificial drainage.

Desiring more definite information, the Universal Portland Cement Co. selected the stretch of newly built pavement mentioned above and made a complete study of its vertical movements. The pavement is of first-class design, being 7 in. thick at the sides and 10 in. thick at the center and of two-course construction. The base was 1:2½:4 pebble concrete, and the wearing surface was 1:1:1½ concrete. Reinforcement consisting of No. 27 triangle mesh wire fabric weighing 41 lb. per 100 sq.ft. was placed between the base and the wearing course.

The pavement was completed before it was decided to make the investigation, and it was impossible to determine the character of the subgrade by means of borings. However, the engineer of construction had observed the character of the subsoil, and his description was supplemented by scattered borings taken outside the curb. From slab 1 to 38, the subgrade may be described as spongy, tough, compact clay; from 39 to 45, sand loam with spongy under-stratum and compact crust; from 56 to 70, clay and loam with some fine sand, the ground being spongy with sand below; and from 79 to 86, the south end of the pavement, sand of more than 3 ft. depth.

As soon as the pavement was completed a series of precise levels at three points on each side of every expansion joint were taken. The points were situated 4 ft. from each curb and at the center and permanently located by small holes drilled in the steel expansion plates. The initial reading on each joint was accurate to 0.1 mm. and was taken on Oct. 27 and 28, 1916. Subsequent readings were not taken at definite intervals, but when weather conditions indicated that change might be taking place in the subgrade. Eight readings were taken during the 12 months, the last on Oct. 25 and 26, 1917. Coincident with each reading a survey was made of the surface, and all cracks were plotted.

Data on the temperature and rainfall were collected from the United States Weather Bureau station at Chicago, which was nearby. After collecting this mass of data, there being 4176 elevations taken, each requiring three rod readings, much work was necessary to put it in shape that would permit of study. Out of 86 slabs, 56 cracked. Thirty-eight which cracked deflected at one or both points more than $\frac{7}{16}$ in. in the 32-ft. width between outside points, 18 deflected less than $\frac{7}{16}$ in., and of these deflections eight were between $\frac{3}{8}$ in. and $\frac{1}{16}$ in., while four slabs having as great deflection failed to crack. Six of the ten remaining slabs which cracked, having maximum deflection of from $\frac{3}{8}$ to $\frac{3}{16}$ in., evidently cracked from abnormal settlement of a portion of the subgrade below the original level. The cracking of four slabs, with maximum deflections between $\frac{3}{16}$ in. and $\frac{5}{16}$ in., is hard to explain unless the deflection had been greater at some period between readings. Every slab reaching a deflection of more than $\frac{7}{16}$ in. cracked. Therefore, it is safe to assume that such deflection in 32 ft. of width is sufficient to crack any pavement built in accordance with present specifications. It is also evident that even greater deflection than $\frac{7}{16}$ in. can be expected when the subgrade is clay or loam with no other protection than underdraining. From study of the data collected it was shown that practically no longitudinal cracks occurred where the deflection was



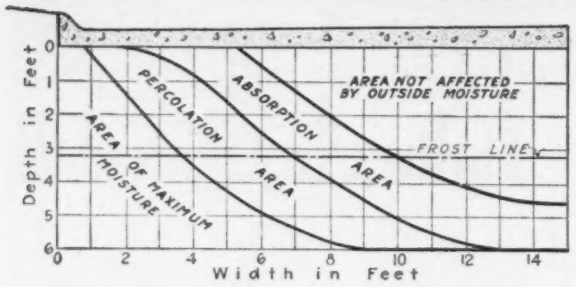
VERTICAL MOVEMENT OF SLABS COMPARED WITH REFERENCE TO RAINFALL AND TEMPERATURE

less than $\frac{1}{32}$ in., and that where the subgrade has a uniform moisture content the deflection would probably never reach this figure, which conclusion is substantiated by those slabs which were over the sand subgrade.

Thirteen consecutive slabs at the extreme south end of the pavement and on a sand subgrade acted quite differently and more uniformly than the others. The average upward movement was $\frac{7}{16}$ in. on the west side and $1\frac{1}{16}$ in. on the east side, while the center rose $\frac{3}{32}$ in. However, the movements were so uniform that the greatest deflection was $\frac{1}{8}$ in. and no cracking occurred. Unlike the other slabs, there was practically no settlement below the initial reading, the greatest settlement recorded being $\frac{3}{32}$ inch.

The movements of two typical slabs, together with the rainfall and temperature, are shown on the charts. Upon freezing, the sides and centers of these slabs at first began moving up uniformly. During the cold weather considerable snow fell, and then in the first week of January a thaw occurred followed by extremely low temperature for the next eight weeks. In this period, the sides of slab 18 on clay subgrade rose more rapidly than the center until a maximum deflection of $\frac{5}{8}$ in. occurred, while slab 86 on sand subgrade rose only $\frac{6}{16}$ as high, there being practically no deflection. These concrete slabs were exactly alike and precipitation and temperature were the same, the only difference being in the character of the ground on which they lay.

Since the subgrade is of inert material of similar nature, the only difference is in the size of the soil grains. Without going into details, the relation of moisture in soils to their volume depends upon the relative size of these grains. It is permissible to state that the finer



DISTRIBUTION OF MOISTURE PREVAILING IN UNPROTECTED CLAY AND LOAM SUBGRADES

the grains the greater the resistance to passage of water by gravity, the greater the change in volume for a given percentage of water contained and the greater the expansion of the mass due to freezing. This statement is borne out by the movements of slabs 18 and 86 which are shown on the charts, slab 18 being on fine grain material and slab 86 on coarse grain material.

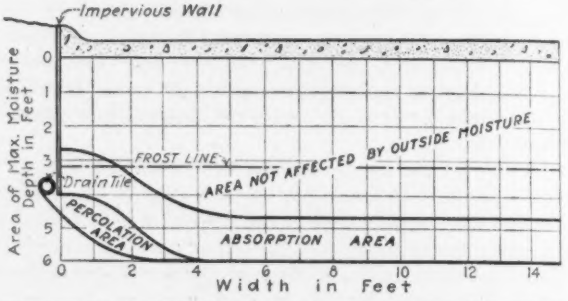
Having the facts, their bearing upon the problem was next considered. The moisture content below the central portion of a pavement will probably never be much less than when the pavement is laid because there is no surface from which it can be evaporated. Since surface water from each side seeps under the pavement, both from static head and the capillary attraction of the soil, the moisture content will vary from an almost uniform degree throughout to a maximum at the sides. Should the soil be compact a uniform condition is not probable at any time, while in sand, which is more porous, the water has less resistance to overcome and reaches a uniform condition quite rapidly. A study of moisture distribution under pavements is shown in an illustration.

Upon freezing, the soil expands in proportion to the moisture contained, and the greater the difference in moisture between the sides and the center, the greater the distortion of the pavement slabs. When a thaw occurs, if the soil is not fully saturated the water sinks and spreads out under the pavement as far as it can go by virtue of head and capillary power. This moisture settles in until it freezes in the voids at some depth where the temperature is still below freezing. In this way an impervious stratum is formed through which the water will not pass. The later seepage is retained above this stratum, and the soil rapidly becomes more water soaked. With the return of colder weather and subsequent freezing of all moisture this subsoil expands, and, being restrained laterally, the pavement is heaved. Naturally, the vertical movement or heaving is greatest at the sides where moisture is at a maximum.

If cracks in pavements are to be eliminated, there are but two general solutions of the problem. One is to overcome by slab design the conditions as they exist; the other to eliminate the condition by controlling the moisture content. The first scheme could no doubt be carried out in several ways, all of which would undoubtedly be expensive. An interesting and possibly less expensive solution is suggested by these experiments.

Variation in moisture can be eliminated by keeping water from percolating under the pavement. Although this is not a new idea, the result desired has not been attained up to the present. Much money has been spent in vain attempts to keep down the water content by the use of drain tile. This has failed simply because the tile do not prevent the water from getting under the pavement, either by pressure or capillary action. If results are to be expected, there must be an impervious underground wall along each side of the pavement, extending down below frost level, and where ground water is present at least 1 ft. lower, to keep capillary water below the frost line. The nearest we have yet come to this type of construction is the old-style 36-in. depth curbing with drain tile laid outside.

A construction that might be as effective and cost less would be a ⅜-in. thickness of continuous jointed or lop-jointed sheets of bituminous material such as is used for pavement joints. This would form an underground wall 4 or 5 ft. deep along each side of the pavement. With 6-in. drain tile laid on a good grade just outside the base, the results that can reasonably be expected in clay or loam are illustrated with this article. The results shown may be compared with those on the other chart, showing the probable conditions of moisture where no impervious wall exists. It is estimated that this wall construction would cost less than $1.25 per lineal foot, and even this might be counterbalanced by decreasing the thickness of the slab and the elimination of reinforcement, which would now be allowable. However, even if the thickness of slab is not decreased, cracks require maintenance, and it is only reasonable to assume that maintenance will increase as pavements become older. If the elimination of cracks would add a small additional life to the pavement, this would represent a saving. If the reduced cost of maintenance and the increased life, when capitalized, should equal or exceed the cost of an impervious wall with tile drain, then such construction is worthy of consideration.



EFFECT OF IMPERVIOUS WALL UPON DISTRIBUTION OF MOISTURE IN SUBGRADES

The investigation is still being conducted on the Kenilworth pavement by Prof. William H. Burger, of the civil engineering college at Northwestern University, who took all the levels mentioned above; also another investigation on Sheridan Road, Winnetka, Ill., and when these are complete further valuable information should be available.

Pennsylvania Railroad Employing More Women

A net gain of 1481 in the number of women employed on the various divisions of the Pennsylvania RR., Eastern lines, was made during the month of June. On May 31 a total of 6873 women were employed in the divisional offices, while on June 30 the figure had increased to 8354. This excludes the general offices in Philadelphia and Pittsburgh, with more than 1000.

Facing Leaky Rock Fill Dam with Timber Planks

After Dam Was Raised 25 Feet, Old Concrete Facing Leaked, So Three Rows of Creosoted Boards Were Placed on Face

By George M. Bull
Consulting Civil Engineer, Denver, Colo.

EXTRA pressure on the Cucharas rock-fill dam in Colorado, due to raising the dam after original completion, caused serious leakage through the concrete upstream facing. After consideration of various remedial measures it was decided to pave this face with three layers of creosoted plank to form an impervious barrier. The work was successfully completed recently.

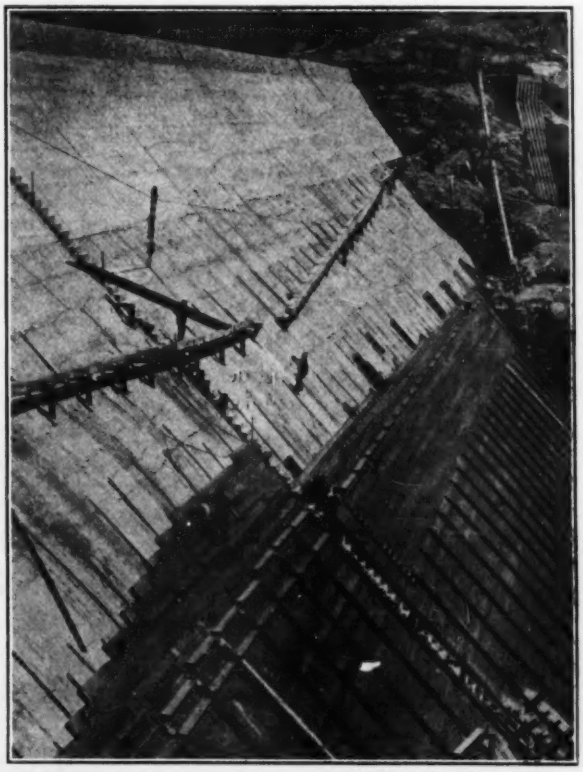
The Cucharas rock-fill dam impounds 44,000 acre-feet of water for irrigation purposes on the Cucharas River about 15 miles below Walsenburg, Colo. It is 125 ft. high, 600 ft. long on the crest and about 250 ft. long on its maximum section at the base. Construction was commenced in 1910 and continued until the structure had reached a height of 100 ft., when owing to the company's lack of funds work was discontinued.

The general type of dam as then constructed consisted of a rock fill, composed of sandstone from the two sides of the canyon, having an inner slope of 1 on 1 and an outer slope of 1 on 1.25. A substantial concrete cutoff wall about 15 ft. in depth was placed across the canyon at the base of the dam, tying the structure to the sandstone bedrock. The water-tight facing consisted of 18 in. of concrete placed in slabs about 8 ft. in width and 10 ft. in height, slightly reinforced by wire, the concrete being backed by about 4 ft. of hand-laid rock. This facing extended to within 5 ft. of the top of the structure as then built and made contact with the solid rock abutment walls on the sides of the canyon, where several thousand yards of waste was deposited over the junction of the concrete and the abutment walls. This facing was not anchored to the cutoff wall across the bottom of the dam except by extending the reinforcing wire into that wall. The solid rock excavation forming this embankment when placed in the fill consisted of about 30% of fine sand and 70% of fairly hard sand rock varying in size from a few inches in the longest dimension to several feet.

In its unfinished condition there was practically no spillway capacity to care for floods, which might reach a maximum of 35,000 sec.ft. for a short period. The outlet was constructed of three 48-in. cast-iron pipes with a concrete base about 1 ft. thick, and with the concrete extending around the pipes for half their height. The entire outlet structure was founded on shale. The controlling gates consisted of three 48-in. Ludlow valves placed on the lower side of the dam with three cast-iron emergency gates at the inlet end.

An examination of the structure by the receiver, after his appointment, showed conclusively that it would be necessary to raise the dam an additional 25 ft., or to a total height of 125 ft., and to construct a spillway to care for flood flow, and also to build a tunnel outlet to take the place of the old outlet so as to insure safe operation of the reservoir. It was not at that time anticipated that the rock fill with its concrete facing and cutoff would prove to be unsafe.

During 1913 the embankment was increased in height to 125 ft. with downstream slope of 1 on 1.5, and a spillway was constructed. The following year the new outlet was built. The first attempt at filling the reservoir demonstrated that the dam was unsafe until the facing had been entirely rebuilt up to the junction of the original facing and that placed above in heightening the dam. As soon as the gates were closed and the water level in the reservoir raised, seepage commenced



PLACING PLANKS ON FACE OF DAM. SLOPING TROUGHS CONVEY GROUT

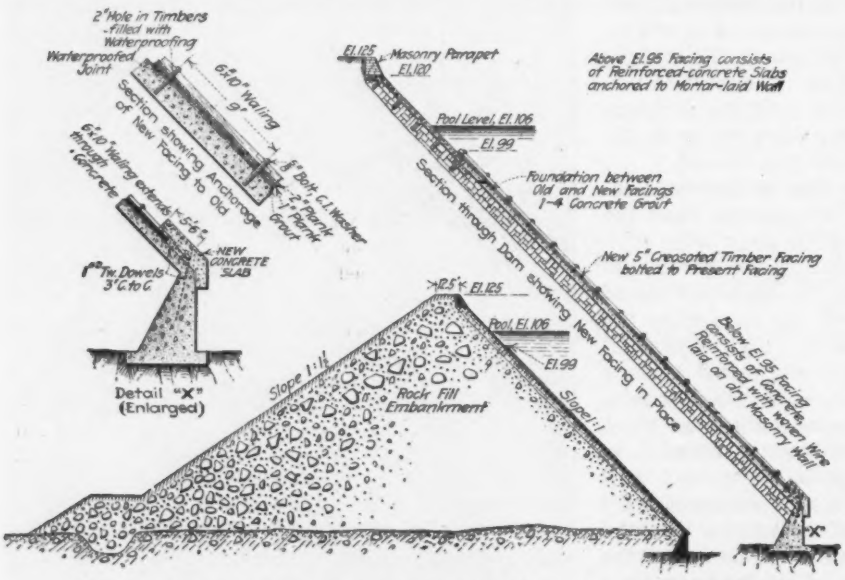
to appear at the lower toe of the dam and when the water surface reached the height of 70 ft. the seepage was 30 sec.ft. A large volume of sand was washed out of the embankment and the structure over the outlet pipes settled 2½ ft. Water was then withdrawn and the water level maintained at a height of not over 50 ft. While 10 or 12 sec.ft. of seepage occurred at that elevation, there was practically no further settlement of the structure.

The general conditions developed indicated that seepage occurred to a greater or less extent in three ways: (1) It was apparent that there was a considerable seepage along the toe of the concrete facing at its junction with the cutoff wall; (2) the various cracks throughout the concrete facing were causing a considerable loss of water; (3) the junction between the concrete facing and the abutment walls at the sides of the dam was not impervious.

Several schemes of reconstruction were considered, in all cases for the purpose of renewing the facing to an elevation of about 100 ft. above the base of the

dam, leaving the upper 25 ft. which was intact in its present condition. These consisted of: (1) A new reinforced-concrete face; (2) a combination of concrete and steel facing, and (3) creosoted timber facing. The high cost of materials during 1916 and 1917 led to the adoption of this latter type of facing.

The plans adopted required the excavation of the silt which had accumulated to a height of some 18 ft. above the base of the dam on the water face in order to expose the junction of the cutoff wall and the concrete facing so that the joint between the two might be repaired and a foundation formed for the timber facing; also the removal of several thousand yards of loose rock and earth at the juncture of the dam and abutment walls in order to expose the joint of the concrete facing and the side walls. Excavation had to be made into the solid rock abutment walls to form an impervious joint between the new facing and the abutment walls. Finally, the new facing had to be placed, together with its concrete foundations and ties.


2"Hole in Timbers filled with Waterproofing
Waterproofed Joint
6"x10" Waling
9'
Section showing Anchorage of New Facing to Old
6"x10" Waling extends through Concrete
1" Bolt, C.I. Washer
2" Plank
1" Plank
Grout
NEW CONCRETE SLAB
1" Tie Dowels 3' C. to C.
Detail "X" (Enlarged)
El. 125
Masonry Parapet El. 102
Above El. 95 Facing consists of Reinforced-concrete Slabs anchored to Mortar-laid Wall
Pool Level, El. 106
El. 99
Foundation between Old and New Facings 1-4 Concrete Grout
Section through Dam showing New Facing in Place
New 5" Creosoted Timber Facing bolted to Present Facing
12.5'
Pool, El. 106
Slope 1:1
Rock Fill Embankment
Below El. 95 Facing consists of Concrete Reinforced with Woven Wire laid on dry Masonry Wall
X

THREE LAYERS OF PLANKS MAKE CUCHARAS DAM WATER-TIGHT

The timber facing consisted of three layers of creosoted Oregon fir lumber placed horizontally across the face of the dam, the upper and lower layers being of 2 x 12-in. material, dressed on one side, and the middle layer of 1 x 12 in., dressed on one side. All edges were dressed to give uniform widths of material. Between the old concrete facing and the lower layer was placed one thickness of felt waterproofing and between the lower 2-in. plank and the 1-in. plank above were placed two layers of felt waterproofing, treated with a heavy coating of hot bituminous cement between the layers. The planks were thoroughly spiked together and held in place by 6 x 10-in. waling pieces, also creosoted, spaced 9 ft. centers and bolted down every 9 ft. to the original concrete facing. The timber facing was brought to a solid bearing with the original work by grouting in the space between the timber work and the old concrete. In order to provide for the swelling of the lumber when wet ¾-in. joints were left between the 2-in. planking, with the 1-in. plank laid tight.

Alternate methods were planned for founding and tying the new facing to the existing cutoff wall, the method used to be adopted upon determining the condition of the joint between the old facing and the old cutoff wall.

The placing of all tie bolts in the old facing, placing of the inner plank of the new facing, and grouting of the facing when in place, as well as all trenching in solid rock, was done by force account. The remainder of the work was done under unit prices.

The excavation of the material from the toe of the dam across the bottom for about 250 ft. consisted almost entirely of silt deposit and was excavated by the use of a steam pump delivering about 3 sec.ft. under a pressure that washed the material from place and carried it through the original outlet and down the river. The remainder of the excavation, which consisted of a mixture of rock and earth, was excavated by hand and deposited in spoil banks on the inner side of the dam. On the completion of the excavation exposing the junction of the cutoff wall and the base of the original facing it was found that the entire joint had broken between the two and that a space varying from ¼ in. to 3 in. had opened up along the entire joint. The cutoff wall itself was found to be intact. The joint was repaired by anchoring the new concrete slab into the old concrete of the slab and cutoff wall and thoroughly capping the break between the two. On exposing the joint between the abutment walls and the facing, additional cutoff trenches some 10 ft. deep were excavated and the old and new facings extended into the additional tie.

Owing to the irregularity of the original facing it was found that the best way of placing the timber facing was to set a series of vertical guide planks on the old face, spaced 5 ft. apart, about 4 in. wide and of such a varying thickness as was necessary to bring the new facing when placed to a fairly even surface horizontally, and with such slight changes in slope as were necessary vertically to bring the vertical breaks in slope at the junction of the waling pieces. These guide planks made the average thickness of the grouting between the new and old face not more than 3 in. The bottom layer of felt was placed on this foundation in horizontal strips and the lower planking laid and lightly nailed in place with the expansion joint for swelling. The bottom layer of planking was entirely completed across the dam for a height of 18 ft. on the slope (that is, the length of one waling piece) before the remaining planking was placed.

This work was then followed up by the laying of the remaining waterproofing and two upper layers of planking, during which period the next lift of 18 ft. of lower planking was placed. On the completion of

the three layers of plank for an 18-ft. lift a set of walings was placed across the entire structure and bolted down. The grouting, consisting of one part cement and four parts sand, was then run under the finished planking of an 18-ft. lift. It usually required two separate runs in two days to complete the entire grouting, as it was found that only about 9 ft. could be run without danger of straining the walings.

The placing of the grouting was accomplished by the use of two concrete mixers, one on each side of the dam, with conveying flumes from each side meeting at the center. These flumes were tapped at the required point and the grouting allowed to flow down the face of the dam to place. All timber work used was framed at the end of the dam and delivered by a carrier that operated by gravity and was tripped from the loading point. The average facing placed per day of ten hours was about 2500 ft., board measure, including the loss of time in grouting, changing flumes and doing preparatory work on the face.

The lumber used was No. 1 common Oregon fir, treated with 8 lb. of creosote per cu.ft. The field tests made as to the swelling of this material when thoroughly wet consisted in sawing test pieces from the planking about 8 in. in length and submerging them for several weeks in water which was constantly heated. The greatest swelling that was recorded for 12-in. dressed planking was $\frac{3}{4}$ in., varying from that measurement to one-fourth of an inch.

Within three weeks after the completion of the facing the water level in the reservoir stood at 71 ft., which was practically the height of water at which 30 sec.ft. seeped through the original facing. There was practically no seepage that could be measured through the new lumber facing, and the entire flow through the surrounding abutment walls, as near as could be measured, was $\frac{3}{4}$ sec.ft. The entire cost of the reconstruction was about $42,000. The unit price for timber work was equivalent to $20 per thousand in place; concrete, including cement, $10 per cubic yard; excavation of dry earth, 60c. per cu.yd.; solid rock, $1.50 per cu.yd.; wet excavation, either rock or earth, $3 per cu.yd.; the total amount of force account work, including preparation of the facing and trenching, was about $6000, of which some $3000 was spent on the facing. The total timber used in the face was about 230,000 feet board measure.

The contractors were Smith & McDowell, of Pueblo, Colo.; Thomas Murphy, superintendent. For the company, Charles Barwick, of Denver, was engineering inspector. The writer prepared the plans and supervised the construction, and was indebted to H. T. Cory, consulting engineer, of San Francisco, for many helpful suggestions in connection with the work.

Mexican Labor May Be Imported

Importation of unskilled labor from Mexico, to meet the present shortage, is facilitated, it is believed, by an order from the Secretary of Labor which removes temporarily the head tax, literacy test and contract-labor regulations imposed under the immigration act. This applies only to labor for railway maintenance, farming and mining work. No aliens will be admitted under this new ruling unless arrangements for their employment have been made.

Equivalent Uniform Loads for Indeterminate Structures

Method Worked Out for Ordinary Trusses Applied To Curved Influence Lines—Wheel-Load Complications Avoided

By D. B. Steinman
New York City

WHEN live-load stresses in arches, continuous bridges or suspension structures are calculated by use of equivalent uniform loads, an undetermined error is involved if the same load values are employed as for simple truss bridges. In several practical cases this error has been found to be negligible, but this fact does not give assurance against large error in other cases.

The writer therefore has made a special study of the matter, and finds that the error is rarely greater than 2%, and where it does pass this limit a correction factor is easily applied. The results of this study are given below in condensed form.

For simple, determinate structures, all influence lines are rectilinear, and the influence area for any particular stress is usually a simple triangle (Fig. 1). In such case the equivalent uniform load (for a given locomotive loading) depends only upon the horizontal lengths, l_1 and l_2, of the two segments of the influence triangle. This principle constituted the basis of the chart of equivalent uniform loads published in *Engineering News* of Apr. 22, 1915, p. 780.

Typical influence diagrams for arches and continuous bridges (Figs. 2 and 3) show influence areas of two kinds—the segment type, Fig. 4, and the combination type, combining segment and triangle elements, Fig. 5. In each case the curved segment may with sufficient accuracy for the following discussion be assumed a parabolic curve.

Load-Position for Parabolic Influence Lines

For maximum stress where the influence line is a parabola, it is easily proved that the center of gravity (R) of the loading must come directly over the middle ordinate of the curve (Fig. 7). Accordingly, in the case of the conventional (Cooper's) engine loading, it is found that the load-position for maximum stress is given by advancing the train until the head of the uniform load is at

$$u = l_1 + 142 - \sqrt{3800 + l_1^2} \qquad (1)$$

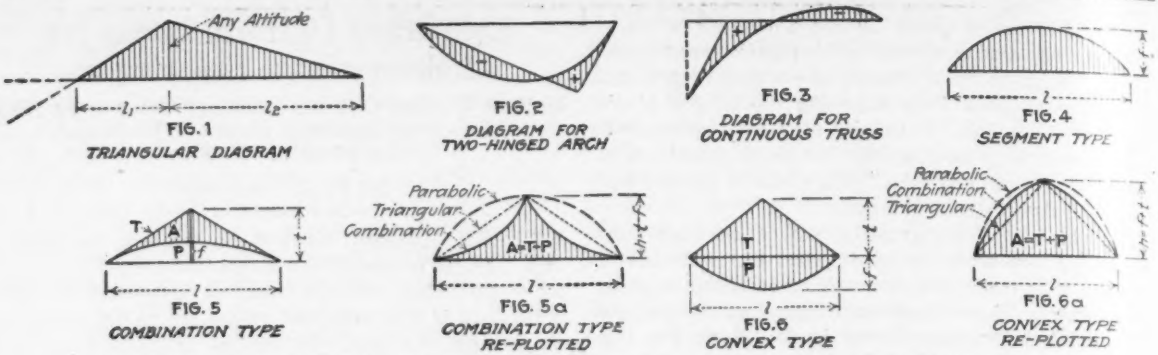
from the left end of the span. This formula cannot be used for values of l_1 less than 57 ft., as in such case the uniform load does not enter the span. A simplified substitute for the above formula, giving correct results if l_1 is greater than 80 ft., is

$$u = 142 - 1800/l_1$$

In the case of a triangular influence area, of sufficient length to admit the head of the uniform load, the value of u for maximum stress is always 142 ft. Hence the second term in the preceding equation shows the additional distance the entire train load must be advanced because of the curvature of the influence line.

Live-Load Stress with Parabolic Influence Line

A train of concentrations produces the stress $S = \Sigma P y$, where y is the ordinate of the influence diagram under each concentration P. If the influence line is



DIFFERENT FORMS OF INFLUENCE ARE FOR WHICH EQUIVALENT UNIFORM LOADS DIFFER

straight, the loads may be replaced by their resultant R, and the stress will be $S = RY$, where Y is the ordinate under R, *i.e.*, under the center of gravity of the applied loads.

In the case of the curved influence line, the loading may likewise be replaced by its resultant, R, provided a proper correction term is deducted. This correction term depends upon the deviation of the curve from the tangent at R. If the influence line is a parabola (Fig. 7), we thus obtain the following expression for the stress:

$$S = \Sigma Py = RY - \frac{4f}{l^2}\Sigma Pa^2$$

where a is the respective distance of each concentration (or load element) P from the resultant R. The less scattered the loads, the less will be the resulting reduction of stress represented by the last term in the above expression.

It should be noted that this correction term is a constant for varying positions of the train of concentrations, so that the stress S will vary only with the term RY. Consequently S will be a maximum when Y has its maximum value f. When this occurs, the equation reduces to

$$\text{Maximum } S = f\ (R - 4\ \Sigma Pa^2/l^2)$$

Equivalent Uniform Loads for Parabolic Influence Lines

Dividing this expression for maximum stress by the area of the parabolic influence segment, $\frac{2}{3}\ f\ l$, we obtain a general expression for the equivalent uniform load:

$$q = \frac{3}{2l}\left(R - \frac{4}{l^2}\Sigma Pa^2\right) \qquad (2)$$

Applying Cooper's E 60 loading in the position prescribed by eq. (1), and substituting the resulting values of R and $\Sigma\ P\ a^2$ in eq. (2), there results the following formula for equivalent load:

$$q = 3000 - \left(\frac{1920}{l}\right)^3 + 24{,}000\left(\frac{m}{l}\right)^3.$$

where $m = \sqrt{3800 + l_1^2}$ and $l = 2\ l_1$. This expression is exact for any value of l greater than 114 ft. ($l_1 > 57$).

Although the above formulas for q have been derived on the assumption that the curve is a parabola, there will be no sensible error in applying them to any other segmental influence lines; any minor variations in curvature are automatically taken care of in multiplying q by the included area.

The figures of Table 1 show that for any length exceeding 90 ft. the maximum difference between the equivalent uniform loads for triangular and segmental influence lines is 2%. Above 225 ft. the maximum difference is less than 1%. That the differences are very small is still better shown by the graphs of the equivalent-load formulas, Fig. 8.

TABLE I. EQUIVALENT UNIFORM LOADS FOR E60 LOADING

Length	Pounds per Track: Segmental Influence Area	Pounds per Track: Triangular Influence Area	Ratio
20	12,390	12,390	100.0
40	9,250	9,850	94
60	8,130	8,660	94
80	7,780	8,100	96
90	7,660	7,920	98
100	7,790	7,650	102.0
110	7,810	7,660	101.9
120	7,760	7,680	101.1
130	7,650	7,650	100.0
140	7,530	7,590	99.4
160	7,320	7,460	98.1
200	7,025	7,140	98.5
300	6,530	6,510	100.3
400	6,340	6,290	100.9
600	6,150	6,128	100.4
800	6,090	6,072	100.3
1,000	6,050	6,046	100.1

The small magnitude of the differences suggests the desirability of the following method for treating curved influence lines: Use the equivalent uniform load given (by chart or formula) for ordinary triangular influence lines, and apply a small percentage correction to be obtained by interpolation from the foregoing comparison table or diagram. Thus, for $l = 500$ the ordinary value of q is 6185; adding a correction of 0.65%, as

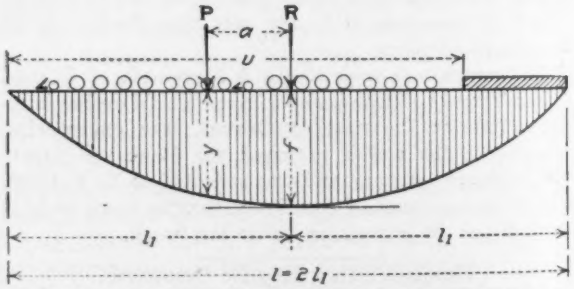


FIG. 7. TRAIN LOAD AND PARABOLIC INFLUENCE AREA

read from the table, we obtain 6225 as the equivalent uniform load for a segmental influence line.

It should be noted that the length l does not necessarily represent the span, but merely the horizontal length of the particular influence area under consideration.

A combination influence area (Fig. 5) may be re-

garded as the difference between a triangle of altitude t and a parabola of height f. If the ordinates are replotted on a straight-line base, there results a diagram of the form shown in Fig. 5a. Since the sides in this case are concave, instead of convex as in the parabolic influence line, the variation from the standard triangular influence diagram is reversed in direction, and the percentage corrections to be applied to the standard values of q are consequently changed in sign. This

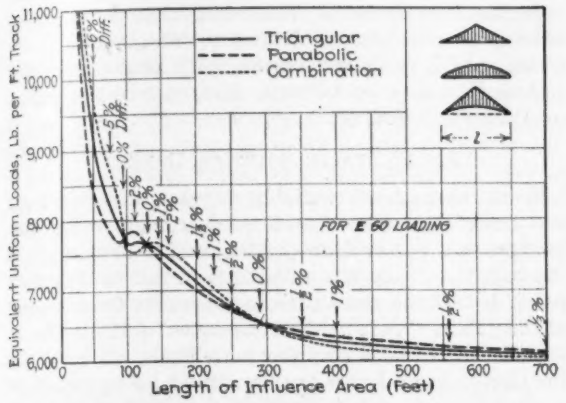


FIG. 8. EQUIVALENT UNIFORM LOADS FOR THREE TYPES OF INFLUENCE AREA

reversed relationship is indicated by the relative positions of the two dotted graphs in Fig. 8, representing combination and parabolic influence lines, respectively.

If we denote the parabolic percentage correction by p, and the corresponding correction for the combination influence line by c, it may be shown that the correction c is equal to minus p multiplied by the ratio of the parabolic area (P) to the combination area (A). The following values of c result for different values of the height-ratio (Fig. 5): For $f = \frac{1}{8}\,t$, $c = -\frac{1}{3}\,p$; $f = \frac{1}{4}\,t$, $c = -\frac{1}{2}\,p$; $f = \frac{3}{4}\,t$, $c = -p$; $f = \frac{1}{2}\,t$, $c = -2\,p$.

The last ratio is the limiting case, so that the departure from the basic equivalent uniform load can never exceed twice the amount of the percentage correction (p) determined above for segmental influence lines.

With the relations just established, we may construct the tabulation (Table II) to give, by interpolation, the percentage correction to q for any parabolic or combination influence diagram.

Another form of combination diagram, usually occurring in connection with the influence lines for web members of indeterminate structures, is represented in Fig. 6. Replotted on a straight-line base, Fig. 6a, it is seen to be intermediate between the triangle and the parabola.

For this case it may be shown, by the same reasoning as before, that, for $f = \frac{1}{8}\,t$, $c = \frac{1}{7}\,p$; $f = \frac{1}{4}\,t$, $c = \frac{1}{3}\,p$; $f = \frac{3}{8}\,t$, $c = \frac{1}{5}\,p$; $f = \frac{1}{2}\,t$, $c = \frac{2}{5}\,p$. These fractions of p represent corrections so small that they may, as a rule, be safely neglected. If desired, however, a table of corrections similar to Table II may be constructed.

The foregoing discussion and results indicate that it is usually safe to ignore the curvature of influence diagrams, and simply to apply the equivalent uniform load values established for straight influence lines. The

TABLE II. PERCENTAGE CORRECTIONS TO EQUIVALENT UNIFORM LOADS

Corrections to be added to equivalent uniform loads established for triangular influence lines in order that they may apply to segmental and combination influence diagrams

Length	Segmental Diagram	Combination Diagrams $f = \frac{1}{8}\,t$	$f = \frac{1}{4}\,t$	$f = \frac{3}{8}\,t$	$f = \frac{1}{2}\,t$
95					
100	+2.0	—0.4	—1.0	—2.0	—4.0
120	+1.1	—0.2	—0.6	—1.1	—2.2
130					
160	—1.9	+0.4	+0.9	+1.9	+3.8
200	—1.5	+0.3	+0.8	+1.5	+3.0
250	—0.6	+0.1	+0.3	+0.6	+1.2
300	+0.3	—0.1	—0.1	—0.3	—0.6
350	+0.6	—0.1	—0.3	—0.6	—1.2
400	+0.9	—0.2	—0.5	—0.9	—1.8
500	+0.6	—0.1	—0.3	—0.6	—1.2
600	+0.4	—0.1	—0.2	—0.4	—0.8
800	+0.3	—0.1	—0.1	—0.3	—0.6
1000	+0.1	—0.0	—0.0	—0.1	—0.2

resulting errors in the stresses will generally be less than 2%. In special cases, however, the error may be considerably greater, especially for lengths under 100 ft., where it may amount to as much as 12 per cent.

Where it is desired to eliminate all uncertainty from the results, the method of correction percentages given in this article will enable the exact stresses to be obtained within a small fraction of 1%, while retaining the advantages of employing equivalent uniform loads.

Limit Truck Capacity or Build Better Roads

Discussion in "Public Roads" by State Highway Officials Shows Present Construction Inadequate for Traffic

THAT the demand of motor traffic has exceeded the carrying capacity of our present roads, and that immediate means must be taken to limit loads, if the investment in our highways is to be saved, is the consensus of opinion of several highway officials as expressed in the June issue of *Public Roads*. The various means suggested for controlling traffic are divided between directly limiting the load and making license fees so high for the larger trucks that the same result will be accomplished. The following is a summary of the views of Edwin Duffey, commissioner of highways of New York State; J. N. Mackall, chief engineer of the Maryland State Roads Commission; William D. Sohier, chairman of the Massachusetts State Highway Commission; C. J. Bennett, highway commissioner of Connecticut; Charles M. Upham, state highway engineer of Delaware; and W. G. Thompson, state highway engineer of New Jersey.

Experience of Highway Departments with Motor Traffic

That the experience of the various highway departments with motor traffic has been painful was shown by numerous illustrations, picturing roads in practically impassable condition. These were roads which had been built during the past ten years at considerable expense, and whose designers had never contemplated the possibility of their carrying the tremendous loads to which they have now been subjected. Roads in New York State, built ten years ago for from $10,000 to

$11,000 per mile, having been subjected to a traffic of thirty 7-ton trucks per day can be repaired only at a cost of from $20,000 to $30,000 per mile at present prices. Roads in Maryland, where the quality of construction has been constantly improved for the past ten years, until 6-in. concrete pavements are being used, show serious damage; even the higher concrete types are suffering. Massachusetts has 2600 miles of main roads, including state, municipal and town roads, which in 1908 cost $100 a mile to maintain. In 1910, due to motor traffic, the maintenance had increased to $300 a mile per year; and now with $2,000,000, or $770 per mile per year, to spend, the state found it necessary during the past year to expend $1,250,000 extra for resurfacing. Indications for the present year point to repair costs from 50 to 100% greater than normal, and if through routes are to be used for heavy motor freight traffic, 100% will be a low estimate.

Most Trouble in the Spring

The greatest trouble due to the motor traffic occurs in the spring, according to reports from Connecticut. One water-bound macadam road, surfaced with 7 in. of trap rock and treated with coal oil, was shown to be practically ruined. The increase in motor truck traffic upon this route in three years was from zero to 200 five-ton trucks per day. Roads of this character are not built for such heavy traffic. When it occurs, particularly in the spring, they are rapidly destroyed. The damage that can be done by only one truck was shown by an experience in Delaware. The state has many miles of water-bound macadam roads which were partly worn out and which were resurfaced with bituminous material. The base of these roads, due to the previous wear, is light and easily destroyed by heavy load concentrations. The instance referred to was one in which a manufacturer in the neighborhood of Wilmington purchased a 5-ton truck for transportation between his plant and the city. This truck, having a gross load of about 11 tons, and making regular trips, very soon broke through the more direct road into the city and changed its route to a parallel road. The parallel road was of light construction but had given good results for several years. A single trip of this truck in the spring of the year put the road in such bad condition that it was impassable for ordinary traffic.

The experience of New Jersey was stated by Mr. Thompson in the following words: "When it is said that New Jersey highways suffered greater damage during the past eight months than during the preceding two years, the statement is hardly exaggerated, as roads which for several years presented very good surfaces became almost impassable under the unprecedented weather and traffic conditions last winter."

The great investment in the highway system of the country is in danger of being partially if not wholly lost, unless immediate steps are taken to remedy the present conditions. Mr. Duffey pointed out that New York State has $140,000,000 invested in highways, and he insisted that this "must be preserved for the many and not destroyed by the few." Even with the present traffic, large amounts of this original investment are being lost, to say nothing about the tremendous economic loss to the state, due to having these roads closed for resurfacing and, in many cases, for reconstruction. That these conditions are considerably aggravated by the difficulty in obtaining bituminous and other materials for repairs, was brought out by Mr. Sohier. Furthermore, the lack of bituminous road oils is having an indirect effect because of dust damage to the crops, particularly the hay crop. The general situation was summed up by Mr. Upham when he said, "The passenger autos demanded that the roads be improved; the trucks are demanding not only improved roads, but pavements of tremendous strength. This means that thousands of miles of the present roads are not strong enough to withstand the heavy auto trucks, and a large part of the vast amount invested in roads today will be lost unless conditions are modified."

An Equitable Solution Desired

What can be done, equitably, to meet the repair bills and insure highways capable of carrying the growing burden, was the evident question in the minds of all the writers. There was a desire to be fair to the motor truck, but at the same time to safeguard the interests of the public. "It is hardly reasonable," said Mr. Mackall, "to expect that a very few individuals, who profit by the use of large heavy trucks, should be permitted to destroy the roads which would ordinarily be used by an infinitely greater number of truck and pleasure vehicle owners, who desire and have a right to use the roads." However, as was pointed out by Mr. Upham, the motor truck, which has been developed during abnormal times, has solved an economic problem, and this solution assures us that not only for the period of the war, but afterward, the use of heavy trucks for transporting freight and express will continue to expand. It was Mr. Thompson's opinion that the weight and dimensions of trucks should be regulated to a point consistent with the ability of the several states to provide highways and bridges strong enough to accommodate them, but at the same time he emphasized the necessity of meeting the present transportation crisis from a patriotic standpoint.

Remedies Proposed to Control the Situation

"There are two remedies for this ill; first, the restriction of the weight of trucks and the stopping of truck traffic when the damage is greatest; and second, the construction of roads sufficiently strong to carry reasonable loads." These are the alternatives as expressed by Mr. Bennett, and the ideas of those who favor the limiting of capacity were expressed by Mr. Duffey when he stated that a reasonable limit upon a properly distributed total load must be placed, and that there should be, if possible, a limit that would remain unchanged for a number of years. It is essential, if highway building is to proceed along scientific and rational lines, that highway engineers be furnished with the total maximum load and the kind of load which must be provided for during the useful life of the construction. It is safe to say that roads already constructed will carry 3-ton trucks. With heavy expenditure, which still would not be beyond control, they could be placed in condition to carry 5-ton trucks. Many believe that the 3-ton truck would answer every requirement of modern traffic, and it would seem, if the Government's war re-

quirements can be met by the 5-ton truck, that this capacity should be ample for use in times of peace.

The impossibility of collecting fees large enough to pay for the damage done to macadam roads by the heavy trucks was brought out by some of the writers. Experience in England, as well as in our own country, has shown conclusively that the cost of maintaining water-bound macadam roads, even when the surface has had a bituminous treatment, has always been ½c. per ton mile, and quite often it has been 1½c. per ton mile. At the average rate of one cent, even a 1-ton truck, making 60 miles per day, for 300 days in the year, would wear the pavement to the extent of $180. A 5-ton truck, at the same rate, would wear the pavement to the extent of $900. The impossibility of collecting such fees from trucks is asserted as being beyond argument.

Of those states which favor restricting the size of truck by large fees, the State of Maryland is the most striking example. This state has a regularly graduated scale, starting with pleasure vehicles at 60c. per horsepower; 1-, 2- and 3-ton trucks, $20 per ton, per year; 4-ton trucks, $100 per year; 5-ton trucks $150 per year; 6-ton trucks, $300 per year; and 7-ton trucks, $500 per year. It is not known whether this scale is too high or too low; it was tried to determine the proper charges by experiment. Massachusetts charges a license fee of $5 for the first ton and $3 for each additional ton. Connecticut restricts the sizes of loads to 25,000 lb. on four wheels.

In Delaware, previous to 1915, license fees for 20-ton trucks would have been the same as for motorcycles; but recently a law has been passed which makes the license fee proportional to the tonnage. It was pointed out, however, that the tonnage is not the proper basis, inasmuch as a 20-ton truck would do infinitely more damage than 20 one-ton trucks. Among the states represented New Jersey allows the heaviest load. Its law limits the maximum width over all to 90 in., the maximum height to 12 ft. 2 in., the maximum length to 26½ ft. and maximum weight to 30,000 lb. Only one trailer is allowed for each motor truck. There was general agreement that some limit should be placed upon the size of trucks, 5 tons capacity being favored by most as the upper limit.

Miles Acid Process May Require Aeration of Effluent

New Haven Experiments Show That Sulphur Dioxide in Effluent Deoxygenates Several Volumes of Diluting Water

By F. W. Mohlman

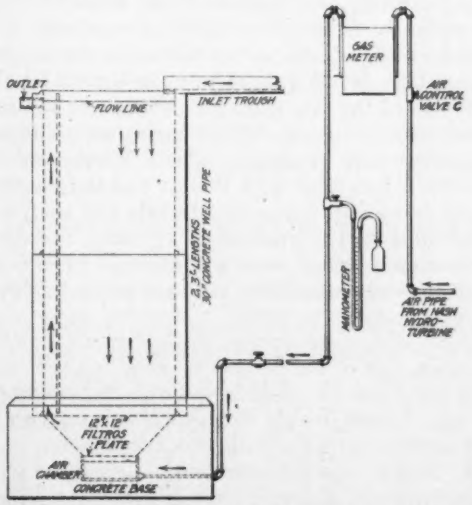
With Engineering Division, Connecticut State Board of Health, New Haven, Conn.; formerly connected with experiments here described

Experiments with the Miles acid process of sewage treatment were conducted at the New Haven sewage experiment station, under the direction of Prof. C.-E. A. Winslow, from June 1, 1917, until May 1, 1918, in comparison with three other processes which have been considered for New Haven conditions. (*Engineering News-Record* of Nov. 1, 1917, p. 829.) Some very interesting facts regarding this process were established during this work. The most notable of these are that the effluent from the process has a large deoxygenating effect and that this may be overcome by a moderate amount of aëration.

The Miles patent (No. 134,280) asserts that the Miles process "1, consists in introducing . . . an inorganic acid as the sole effective agent" . . . and "3, consists in introducing sulphurous acid into the sewage."

Sulphurous acid seems to have a selective toxic action on bacteria which is more intense than is obtained with the same hydrogen-ion concentration of sulphuric acid. The effect of the sulphurous acid is augmented by the germicidal power of the bisulphites formed from the bicarbonates. Therefore, from the standpoint of effective disinfection, sulphurous acid is preferable to sulphuric. It also has the decided advantage of being cheaper, when made as needed by burning sulphur or pyrites, and conducting the gas into a part of the sewage, which can then be used for acidifying the remaining sewage.

We have applied compressed sulphur dioxide to the sewage as it flowed into a settling tank through a galvanized-iron pipe about 20 ft. long. The settling tank was 16 ft. long, 4 ft. wide and 4 ft. deep. The detention period was four hours when 10,000 gal. of sewage per day were treated. After acidification the sewage contains bisulphites and some free sulphurous acid. It also contains lime and magnesium soaps, which are attacked by the acid, liberating the free fatty acids. As the sewage passes through the tank, part of the bi-



EFFLUENT FROM MILES PROCESS WAS AERATED IN TANK

sulphites and sulphurous acid are oxidized to bisulphates and sulphuric acid. The oxidation may easily be followed by determining total SO_2 in both bisulphates and sulphurous acid by titration with thiosulphate against an excess of iodine solution.

Preliminary tests made on Feb. 14, 1918, showed a total content of 118 p.p.m. of sulphur dioxide in the effluent. In order to determine whether this sulphur dioxide would use up the dissolved oxygen in the dilut-

ing water if it were discharged into New Haven harbor, various mixtures of the effluent with sea water from New Haven harbor were made. No especial care was taken to exclude atmospheric oxygen during the mixing. As soon as possible after dilution, dissolved oxygen and sulphur dioxide were determined in the mixtures. The results shown in Table I were obtained.

TABLE I. MIXTURE OF SEA WATER AND MILES EFFLUENT

	Effluent	Sea Water	1 Eff. to 2 Water	1 Eff. to 4 Water	1 Eff. to 9 Water	1 Eff. to 19 Water
Dissolved oxygen	0.8	12.0	1.0	5.0	8.8	11.0
Sulphur dioxide	118	0	8	0	0	0

A great decrease in the dissolved oxygen took place in the dilutions containing 20% or more of the effluent. Further experiments showed that one part of oxygen would be required for four parts of sulphur dioxide in the effluent, according to the reaction $SO_2 + O = SO_3$.

The Miles effluent in our experiments usually contained from 80 to 120 p.p.m. of sulphur dioxide. The alkalinity of the sewage treated was unusually low, averaging but 50 p.p.m., so that a relatively small quantity of sulphur dioxide was required. But even with this small amount of SO_2, averaging 100 p.p.m., 25 p.p.m. of dissolved oxygen will be reduced, or, in terms of dilutions at summer temperatures, one volume of effluent will immediately reduce *all* of the oxygen in 3 to 4 volumes of sea water. The average sewage would require probably twice as much SO_2 as the sewage which we treated, and the effluent would deaërate twice as much water, or 6 to 8 volumes. It is not improbable that there might be a distinct zone of deaërated water at the outfall of the effluent from the Miles process.

In order to determine whether the sulphur dioxide might be oxidized before the effluent is discharged, an aërating tank (see drawing) was constructed by Harold G. Wynne, of the city engineer's office, who assisted in the experimental work. The tank was used both on the fill-and-draw and continuous plan. When used intermittently it was filled with effluent and the air started, samples being withdrawn at intervals and analyzed for sulphur dioxide, the quantity of air being measured at the time each sample was withdrawn. Results of an average experiment of this kind are given in Table II.

TABLE II. AERATION OF MILES EFFLUENT, MARCH 4, 1918

Quantity of effluent ..... 220 gallons
Quantity of air ..... 21.0 cu.ft. at 6.4 in. mercury
Quantity of free air ..... 25.5 cu.ft.

Time, Min.	SO_2, P.P.M.	Reduction, %	Air per Gal., Cu.Ft.
0	78.1		
10	71.7	8	0.029
20	53.8	31	0.058
30	23.0	70	0.087
40	10.2	87	0.116

Effluent mixed with sea water, before and after aëration, dissolved oxygen determined immediately.

Sample	Dissolved Oxygen — Before Aeration	After Aeration
Effluent	1.4	5.8
Sea water	14.2	
1 effluent to 2 sea water	4.4	11.8
1 effluent to 4 sea water	7.4	11.8

The results of this experiment have been substantiated by various other experiments on the fill-and-draw plan. The tank was next used as an aërator on the continuous-flow plan. The effluent from the Miles tank was passed through the tank as shown in the cut, having a detention period of 31 min. Samples of the influent were taken at 3 and 9 a.m. and p.m., and of the effluent 30 min. later. The average results of these experiments are shown in Table III.

TABLE III. CONTINUOUS AERATION OF MILES EFFLUENT

Date	Sulphur Dioxide, P.P.M. Influent	Effluent	Reduction, %	Air per Gal. Cu.Ft.
March 6, '18	99.1	44.9	54	0.10
March 7, '18	70.4	14.4	79	0.10
March 8, '18	72.3	14.4	80	0.11
March 9, '18	69.1	5.2	92	0.10
March 10, '18	81.3	46.4	43	0.10
March 11, '18	80.9	36.1	55	0.06
March 31, '18	53.8	10.2	81	0.10
Apr. 1, '18	108.5	37.4	65	0.10
Apr. 2, '18	90.9	26.5	71	0.10
Apr. 3, '18	71.0	19.8	72	0.10
Apr. 4, '18	92.2	4.5	95	0.10
Average	78.1	23.6	70	0.097

These results are quite similar to those obtained on the fill-and-draw plan, with 30 min. aëration, except that slightly more air is necessary. The close agreement in SO_2 content in the effluent is accidental. In each method 70% of the SO_2 was removed in 30 min. aëration, but with 97,000 cu.ft. of free air per 1,000,000 gal. of effluent when operating continuously, as compared with 87,000 cu.ft. on the fill-and-draw plan.

The aërated effluents did not deaërate the diluting water to an appreciable amount at any time, and thus could be discharged into the harbor with safety. Bacterial counts made by W. S. Sturges before and after the aëration showed that there was practically no change in the bacterial content.

Division of Air Affects Oxidation

Laboratory experiments in which wood plates were used for diffusing the air indicated that the amount of air required could be reduced considerably by diffusing the air very finely. This experience is similar to that found in the activated-sludge experiments at Milwaukee, but it is probable that this oxidation, which is purely chemical, is even more affected by the fineness of division of the air than is the oxidation in the activated-sludge process, which is biological. The quantities of air used in the experiments with the filtros diffusor were from one-fifteenth to one-twentieth of those used in the aëration of the same sewage with activated sludge, so it is probable that the cost of this aëration would be low. The tank used for the aëration was too shallow to be very efficient, and it is believed that the results obtained in these experiments could be greatly improved by further work. While this aëration would make a Miles plant more complicated and the process more costly, it does not necessarily condemn the process, as the aëration period is very short and the amounts of air necessary but a small fraction of those required in the activated-sludge process.

Conclusions

(1) The Miles acid effluent contains unoxidized sulphur dioxide. (2) This sulphur dioxide is oxidized at the expense of the dissolved oxygen in the water in which the effluent is diluted. (3) The sulphur dioxide may be oxidized before dilution by aëration for a short time with relatively small quantities of air. After this aëration the effluent will not deaërate large volumes of diluting water.

Water Company Wins Imperial Valley Seepage Case

Court Holds Raising of Water Table and Damage to Land Adjoining Canal in Sand Not Chargeable to Irrigation Company

A DECISION recently handed down by Judge Franklin J. Cole of the county superior court in Imperial Valley, California, which is considered of great importance to irrigation interests throughout the west, held that an operating company was not responsible for damage through alleged raising of the ground water by seepage from its canal. Noted authorities have been retained in the case, and much evidence of a highly technical character on the subject of ground water flow has been submitted. The high degree of interest attaches to it because this has been a test case and, had a contrary decision been rendered, and sustained by higher courts, hundreds of similar claims would have been filed. The damages involved in such procedure would reach a total sufficient to require assessments on a large portion of the irrigated lands in the valley.

Canal Sole Source of Supply

The test case was brought by land holders on the extreme eastern frontier of cultivation in the valley, against the mutual water companies operating the East High Line Canal. This canal is the sole source of supply in this district, and it was by means of it that the plaintiffs' land was reclaimed from its original desert condition. Plaintiffs asserted that the canal in question was built through a sandy territory of the native soil, and with a grade that kept its channel scoured, thereby forfeiting the protection of the impervious silt deposit which forms the lining of many of the valley canals and acts as an inner seal. As proof of these claims the plaintiffs presented to the court the results of experimental test holes in the damaged land, and near the canal which adjoined it. These results showed that the water in the test holes reflected the rise and fall of water level in the canal, and within a very few hours afterward. To support further their contentions that the scouring of the canal channel increased the rate of seepage, the plaintiffs gave results obtained from experiments with soil samples taken from the inner banks of the East High Line Canal and from other canals where it was agreed that seepage did not occur. Based on these samples effort was made to show that water would seep much more readily from the East High Line Canal than from other canals of the valley.

The burden of proof upon the defendants was heavy, for the plaintiffs' land is undoubtedly water-logged, and its immediate proximity to a canal constructed through sandy soil would at first glance win over a casual observer. The defendants, however, endeavored to establish:

First, that before the canal was built, and while adjoining land was still arid desert, there were occasions when heavy rains in the nearby highlands to the east and north caused large damp areas in the lower lands. This was caused, it was asserted, by the natural ground water escaping to the west, and the existence of large alkali patches, it being a well established fact that the presence of alkali in soil results in a capillary attraction which brings ground water nearer the surface.

Second, that the canal in question was constructed according to the best engineering practice as to location, grade and section, and that it would be impracticable to construct it of any material other than the natural soil. While it was admitted that silt did not deposit in the canal to the extent that it did in other canals, still the seepage through the sandy banks would soon seal them, defendants said. To substantiate this contention, evidence was introduced showing that the same water, even when partially settled, as in the case of the water filtration plant of the City of Calexico, would seal the sand in a slow sand filter if the sand were not cleaned often enough and to sufficient depth.

Third, that excessive irrigation, without systems of drainage canals, was rapidly raising the original ground water table under the land in question as well as in many other parts of the valley, and it was the ground water which was directly the cause of the damage.

Authorities on the flow of ground water were quoted to show that if the water level in the canal had any direct bearing on the depth of water in the test holes, the time required for the canal fluctuations to register in the test holes would be days and weeks, instead of hours as asserted by the plaintiffs. It was contended that a flow of ground water as rapid as the plaintiffs' experiments indicated would result in a veritable flooding of the country. Experiments were also performed by the defendants to show that samples could be so picked from the inner banks of various canals that almost any result could be obtained.

As a mainstay of the defense the theory was advanced that the only value which the land in question ever had was to be credited to the present situation of the canal. Without the canal the land would still be arid desert. Building the canal of other material than the natural soil was prohibitive. If the land was so situated and contained, as it did, certain inherent salts, then if the only feasible canal had destroyed the value the canal itself had created it was incumbent upon the land to suffer the damage.

Irrigation Service by Mutual Companies

The 500,000 acres under canals of this irrigation system are divided into several sections, each served by a mutual water company. These companies own and maintain their own distributing canals and retail the water to the ranchers. A land owner in any section is a stockholder in the water company, to which he pays a prescribed amount for water, plus a periodical assessment to pay the cost of maintining the mutual water company's properties and retailing the water. These companies buy water from the parent concern, the Imperial Irrigation District, a municipal corporation organized along the lines of the county government. It maintains the main canal system and flood protection levees. Thus, a suit against a mutual company is not an action against a public service corporation but is a suit against a community of ranchers taken collectively.

The question of liability of an organization such as a mutual water company in the case of damage to desert lands whose value was created by the construc-

tion of the canal causing the alleged damage is believed to be new. If the plaintiffs win in higher courts it is believed to mean that all lands in the Imperial Valley suffering from rising ground water, whether caused by alkali, insufficient drainage or canal seepage, may demand of the other lands the cash difference in value between them.

Engineering Salaries Adjusted to Cost of Living

Monthly Bonuses Paid in Cuyahoga County, Ohio, in Accordance with Variations in Six Groups of Family Expenses

By W. A. Stinchcomb
Engineer of Cuyahoga County, Cleveland, Ohio

EMPLOYEES of the engineering department of Cuyahoga County, Ohio, who are on the monthly payroll now receive a bonus which is fixed as nearly as we can determine it in accordance with fluctuations in the living expenses of the ordinary family, grouped under (1) food; (2) clothing, including shoes; (3) fuel and light; (4) rent; (5) miscellaneous; (6) savings.

In our department the salaried employees range in wages from about $1000 to $3600 per year. It was quite apparent that it would not be fair to pay bonuses on the same index to all the men, for it was easily seen that in the case of the employee with a small salary the percentage which he would spend for food would be greatly in excess of that which the higher salaried man would expend for the same commodity. Accordingly, a questionnaire was prepared, and each employee was asked to state anonymously the percentage of his income which he spent for the before-mentioned items. Employees were grouped in three classes (see table).

TABLE I. PERCENTAGE DISTRIBUTION OF LIVING EXPENSES AND SAVINGS FOR THREE CLASSES OF SALARIES

	Class A Less than $1,600	Class B $1,600 to $2,400	Class C Above $2,400
Food	38%	37%	24%
Clothing and shoes	15%	14%	12%
Fuel and light	5%	6%	3%
Rent	21%	21%	14%
Miscellaneous	13%	12%	27%
Savings	8%	10%	20%

The apparent discrepancies in Class C are attributed to the small number in that class.

Having determined approximately the percentages of income which were being spent under the various headings, the next difficulty arose in attempting to find some authentic information which would give comparative prices, from month to month, which might be grouped under the various commodity headings. The Department of Labor gathers statistics along this line, but its publications are given out too long after the current month to make useful the application of the information. Accordingly, I went to Bradstreets, and we are using Bradstreet prices, modified to a certain extent, as a basis.

We are making our comparison as of Jan. 1, 1917. In the cases of fuel and light, corrections had to be made in order to fit local conditions, because in this city a great deal of heat used is obtained from natural gas, and there has been no variation in price during the period covered. So, as with light, a fixed price is maintained for illuminating service. It was necessary again to divide the item of average fuel and light into two classes: gas and electricity, and coal. Information with reference to the average increase in rents was obtained from the Real Estate Board of this city. In order to determine "Miscellaneous" certain classifications in Bradstreets were used; namely, metals, building material, drugs, chemicals and miscellaneous. An investigation disclosed the fact that under the heading "Miscellaneous" the employees had certain fixed expenses which present economic conditions had not changed, among which might be mentioned insurance, both life and fire, forming in some cases a considerable portion of a miscellaneeous item. Also transportation, which until the past month or so has not been affected. It was found that these constants amounted to about 50% of the miscellaneous items, and so the index shown by the use of the above commodities from Bradstreets was divided by two in order to get the index for "Miscellaneous," as we used it.

During the past two years this department has in a way attempted to keep abreast of or at least to follow along with the upward trend of prices by a readjustment of salaries about twice a year. Inasmuch as we were about to install a system which made its base that of January, 1917, the base salary had to be adjusted to fit that condition. This was done.

Table II shows the way the bonus has varied during the past three months.

TABLE II. CLEVELAND COMMODITY PRICES IN 1918 COMPARED WITH JAN. 1, 1917, AS BASE; AND "H. C. L." SALARY INDEX

	Jan. 1918	Feb., 1918	Mar., 1918	April, 1918
Food	1.334	1.36	1.33	1.33
Clothing and shoes	1.22	1.225	1.244	1.294
Gas and electricity	1.00	1.00	1.000	1.000
Coal	0.834	0.835	0.833	0.825
Rent	1.125	1.125	1.125	1.125
Miscellaneous	....	1.19	1.185	1.184

"H.C.L." Salary Index, Percentages

	Class A	Class B	Class C
Feb., 1918	21.7	21.2	17.9
Mar., 1918	20.9	20.0	17.5
Apr., 1918	21.66	20.71	18.08

Mine Concrete Designed by Empirical Methods

Cut-and-try measures have been used in designing underground concrete structures on the iron ranges in Minnesota, for it is quite impossible to determine pressures. Ore beds frequently move without warning and exert tremendous crushing effect. Details of geological formation are frequently unknown in advance. If the strata are horizontal side pressures may be negligible, but with inclined strata the pressures may be enormous. Since the compelling reason for the use of concrete is its resistance to fire which might shut down a mine indefinitely, the tendency is to make the shaft sections err on the side of strength. The additional cost of concrete is of little consequence, but the space taken up becomes a factor, particularly in relining work. When concrete timbers were first used they were made the same size as the wood timbers which had been used for many years. The 3-in. precast slabs have proved uniformly successful. Dimensions of the monolithic construction are somewhat different from the ordinary timber dimensions, but in general an 8-in. wall is recommended by the iron range engineers as a minimum.

Further Commendation of American Society's Development Committee

Leading Engineers Look for Much Good to Come of Move to Broaden Society's Activities—General Black Inclined to Believe Time Allowed Committee Is Too Short

A number of prominent engineers were asked by "Engineering News-Record" to comment on the creation of a development committee by the American Society of Civil Engineers, as set forth in the issue of June 27, p. 1209. A number of the replies were published July 18, p. 135. Further opinions, given below, are from Major General William M. Black, chief of engineers, United States Army; A. P. Davis, director and chief engineer, United States Reclamation Service; J. F. Coleman, member of the board of direction of the society; J. A. Ockerson, past president of the society; M. M. O'Shaughnessy, city engineer of San Francisco; Sidney J. Jennings, president of the American Institute of Mining Engineers, and George H. Burgess, chairman of the valuation committee of the Delaware & Hudson Company.

J. F. Coleman Holds Development Can Result Only in Good to the Society and to the Profession

I regard the appointment of the committee on development by the board of direction of the American Society of Civil Engineers as most hopeful of far-reaching and beneficial results to all concerned. The appointment of the committee on development in the manner provided by the resolution cannot result otherwise than in benefit to the society and to the profession. The researches and deliberations of the committee must surely disclose ways and means of so broadening and enlarging the scope and the functions of the American Society of Civil Engineers as to render it a more potent factor in affairs than it has yet been. I am in most hearty accord with the resolution.

J. A. Ockerson Sees in Move a Means of Increasing Society's Efficiency—Must Have Hearty Co-operation of Members

It is gratifying to find *Engineering News-Record* fully in accord with the preamble and resolutions recently adopted by the board of direction of the American Society of Civil Engineers, appointing a committee on development. The action of the board, seeking the general uplift of the society in its relations to the public and within its own ranks, is admirable from all points of view and will doubtless result in a fuller understanding of the privileges and responsibilities of membership, and with it a wider sphere of influence and efficiency.

While all of this is true, the fact should not be overlooked that this is not the first step taken by the board of direction and the society looking to similar ends through active participation in the current questions of the day touching the engineer, his activities and his influence.

The American Society of Civil Engineers has been the pioneer in many matters of importance to the profession and the general public. Having been a member of the board of direction for some eight years, and seven years a member of the nominating committee, the writer has a pardonable pride in the achievements of the society thus far. The advancement of the society, the interests of its members, and the relation of both to the public, have been constant themes of discussion in the board, and substantial progress has been made, which is evidenced by the enviable standing of the society today in its relations to the Federal Government and the public at large. It has taken a leading part in the international engineering congresses held at St. Louis and at San Francisco, in the inventory of our manufacturing resources, in the organization of the Naval Consulting Board, in the classification of engineers according to qualifications for service in war activities, in proclaiming its loyalty and desire to aid our country in every practicable way, and in efforts to obtain just legislation relating to the practice of engineering.

In a material way, the reports of its committees on cement, reinforced concrete, standard rail sections, columns and struts, and numerous other important subjects, show earnest, careful work and the conclusions have been adopted as standard practice.

In later years the board of direction has encouraged research work in the appointment of committees and the allotment of funds therefor.

It has endeavored to increase the interest of the members in the society, by authorizing and encouraging local associations of members, by defending members wrongfully accused and bringing to justice those who are guilty of wrongdoing, by providing for meetings of the society at places other than New York, by fixing the time and place of the annual conventions through automatic rotation by geographical districts, by providing representation of the districts in the board of direction. So it will be seen from the partial list of things accomplished that the society has by no means been idle, but has kept pace fairly well with the growth of the profession—but progress can only be realized by sustained, persistent effort.

Throughout all its efforts the board of direction has frequently had occasion to regret the lack of interest shown by the members of the society. A ballot on the most vital questions rarely brings out a response from more than one-third of the voting members. So the statement of the preamble that "a readjustment can be accomplished successfully only with the aid of the membership throughout the country" is the crux of the whole matter.

With more than 8000 engineers in the Officers' Reserve Corps who are making good at the front and elsewhere, which brings them into the limelight of public scrutiny, with the economic conditions and industrial activities rapidly changing, with new problems to come with the close of the war, the time is most opportune for the society to redouble its efforts to

increase its usefulness to the public and to its members, by leading and guiding as far as practicable in the solution of the great economic and social problems which will confront us for years to come until normal conditions are again restored. To this end a committee such as proposed can and will render valuable service which will result in greater efficiency, but it must have the hearty coöperation of the members of the society in order to achieve the results hoped for. No half-way measures of encouragement will suffice.

It has been well said that "there is something in the soul and spirit of man which is mightier than the appeal of personal gain." If this feeling among the members can be evoked the success of this movement is assured. Let us all put our shoulders to the wheel and "do our bit" toward aiding the committee in this important work.

Major General William M. Black Believes With Others That More Time Should Be Allowed for Investigation

An important step like that contemplated by the board of direction of the American Society of Civil Engineers is one that should be taken only after very careful consideration, which, doubtless, the board of direction has given the matter. Therefore, criticism or comment should be made with equal care.

I do not feel sure that I grasp fully the intent of the resolutions, nor am I sure that I understand just how the American Society of Civil Engineers could act in order to further the cause which the board of direction has in mind. It seems to me that engineers are bound to take a leading place in the community life of our nation, just as soon as the individuals themselves are found worthy to take it. Perhaps the society might be able to help in the necessary broadening of the views and sympathies of the engineers. I believe that the exercise of the profession itself tends to fit its men to perform civic duties of all kinds eminently well.

I am inclined to agree with some of the members whose comments I have read in thinking that too short a time is allowed for the formation of a proper committee and for the preparation of a report of value. With the short time allowed there is too much of a chance for a small group having clearly defined aims to impress their will on the larger number who have not yet thought the matter out with care. The society has such a high value as an aid toward higher aims and greater achievements for our nation that no hastily prepared changes in its objects or methods should be permitted. I hope that this step will prove one beneficial to the profession at large.

M. M. O'Shaughnessy Hopes Move Will Enable Engineers To Play Part in Economic Reconstruction, and Urges Prompt Action

The proposed project of the American Society of Civil Engineers aims at stimulating and concentrating the energy of this great organization into a direction which will improve, control, and direct sociological and economic conditions, now in a state of flux.

Before the advent of war social and economic problems and controversies were speeding along with unprecedented violence, which indicated an early conflict of class selfishness. The activities of the war have temporarily postponed the climax. The railroads and other utilities are now receiving guaranteed incomes. The labor elements are practically obtaining all the compensation they request, which, during the period of the war, with the increased price of foodstuffs and other commodities, is only a just distribution of burdens and awards. At the cessation of the war this state of affairs will stop and the country will be confronted with new problems which will need all the enlightened direction and skill of not only engineering organizations but the other bodies that have to do with and direct labor and capital.

No other class of men comes into such intimate contact with both factions as the engineers, who have heretofore been unduly modest in making suggestions of value which their great experience and powers of observation qualify them to do. Generally, with undue modesty, they suppress their views and permit noisy demagogues and blatant politicians to direct functions that properly belong to the engineering body.

I trust fruit will be borne from the new move of the American Society and that more results will be obtained than are usually accomplished by the formation of committees which proverbially write verbose reports and which generally so delay the production that the problems are passed before the discussions are closed.

First Step to Important Development in Society's Activities, Says A. P. Davis, But Patience and Courage Are Needed

The resolution of June 18 adopted by the board of direction of the American Society of Civil Engineers without serious opposition is the first step to an important development in the policy of the society which I believe will greatly add to its usefulness. Similar tendencies are shown by a number of other committees appointed recently, so that the development foreshadowed by this resolution is really already begun. There is a growing feeling that the society should take a more active part in the control of public policies where they depend upon, or touch upon, engineering matters.

As an illustration, a recent recommendation of the Engineering Council concerning the bonus system in connection with contracts is an important example of the potential usefulness of the society if this and similar matters are followed up and carried through to fruition. Years ago the Navy Department offered a premium for speed on contract requirements in connection with war vessels. This practice was abolished by Congress with much elocution indicating that a great abuse had been abolished. It is impossible to calculate what this blunder may cost the United States in lives and property and it might, perhaps, have been prevented by vigorous and aggressive action when the question was pending. A common tendency of laymen is to underrate the importance of preliminary investigations of engineering works. Had it not been for a treaty prohibition, it is probable that the Nicaragua Canal would have been taken up for construction in the early 90's under the impression that it could be built for about $60,000,000. As it was, it required a hard fight on the part of Messrs. Ludlow, Noble and Endicott to prevent such as disaster and they probably

could not have prevented it had it not been for the French disaster of Panama which stood as a warning before the country.

The conservative policy of the past concerning public measures has not been due entirely to a spirit of conservatism, but probably in some measure to a dread of antagonism and dissension in the society itself, and the policy now foreshadowed, if consistently and courageously followed to an extent adequate to make the society feel its great usefulness, is bound to be beset by pitfalls and difficulties which should not be underestimated. Patience as well as courage is necessary. The society should confine its advocacy to general principles and policies and the measures necessary to carry them out rather than to engineering details which must be determined by members of the profession, employed for the purpose, who can give it the necessary time, and to which it would not be wise to commit the society as a whole. Even confined to these broad and general functions, abundant opportunities for usefulness will present themselves to the society.

President Jennings of Mining Engineers Calls Action Excellent Preliminary Step — Says It Will Be Brought to Attention of Executive Committee of His Society

The question of the future development of the national scientific societies of the United States thus brought prominently to the front by the civil engineers is one that has exercised the thoughts of the directors of these various societies ever since the United States entered this world war. In the upheaval that has been brought about, various forces with indefinite influence will come to the front, and it seems to me a part of the function of the national engineering societies to consider these forces and to give them direction and consequent effectiveness. The action taken by the civil engineer in appointing a committee to report on this question seems to me an excellent preliminary step. This action will be brought to the attention of the executive committee of the Mining Engineers and, if they approve, a similar committee will be appointed. It is hoped that these committees of the national societies will coöperate with the Engineering Council of the United Engineering Society so that the engineering profession will be organized as a whole in the United States to render the maximum amount of service of which its membership is capable. In all times of the world, and under all circumstances, the engineer has proven himself to be "The Man Who Can," and everywhere and at all times "The Man Who Can" always will.

Should Commend Itself to All Members, Writes George H. Burgess—Much Responsibility Will Lie Upon the Committee

The creation of a Committee on Development of the American Society of Civil Engineers is a step that should commend itself to all members, many of whom have been convinced for some time that the society is not occupying that position to which its large and widely distributed membership entitles it.

The objects of this society should be such as to confer the greatest possible benefits to (a) its members; (b) the engineering profession; (c) the nation. These beneficiaries are not necessarily named in order of importance, though it is obvious that the most successful organization is the one conferring the greatest benefit upon its members, and upon the strength of the organization depends the ability of that organization to confer its benefits upon others. That the society has not accomplished any of the results of that degree to which its size and importance entitle it is well recognized by many of its older members, who undoubtedly will welcome this important step. Much responsibility rests upon the members who will be appointed to this committee and it is to be hoped they will be men of broad vision, keenly alive to their responsibilities, and who may be able to devote a very considerable amount of time to the service of their society and profession.

With the period of readjustment and reconstruction of physical, political and social structures of the world rapidly approaching, the society should so equip itself as to become an important factor in such changes as are certain to arise from this readjustment.

SOCIETY SERVICE

A Section Dealing with the Results of Teamwork by Technical Men

Crystallize Council Action

Activity of the Engineers' Club of Columbus, Ohio, in furnishing a forum for the presentation of views on the seriousness of the water-supply situation, has led to favorable action on this matter by the City Council. Prof. E. F. Coddington, chairman of a committee on water-supply, indicated June 28 from charted studies of daily rainfall records for 20 years and gage readings at the storage reservoir for nine years that the city would now be without water under the present demand in case dry weather conditions obtained such as have been experienced during at least five years of the past twenty. The engineers did not hide themselves, their meeting nor their report. On July 19 Jerry O'Shaughnessy, superintendent of water, appeared before the council with the same unpleasant information. Authorization was granted for the employment of an engineer to make necessary surveys.

In Chicago universal water metering is up for consideration by the city council (see editorial in *Engineering News-Record* of July 18, p. 111). Although starting late the American Association of Engineers has been able since the editorial was written to get into the newspapers eight news items urging the adoption of meters. The last move was to wire the Federal fuel administrator asking him to urge the measure because of the fact that Chicago wastes half the water it pumps, hence half the coal burned, amounting to 100,000 tons a year. With every other industry reduced to short coal rations the association could see no reason why flagrant waste of this kind should continue without the first step being taken toward its reduction. The question of holding mass meetings in the wards of doubtful aldermen to explain the situation is under consideration, since the proposed metering ordinance has been put on file until autumn.

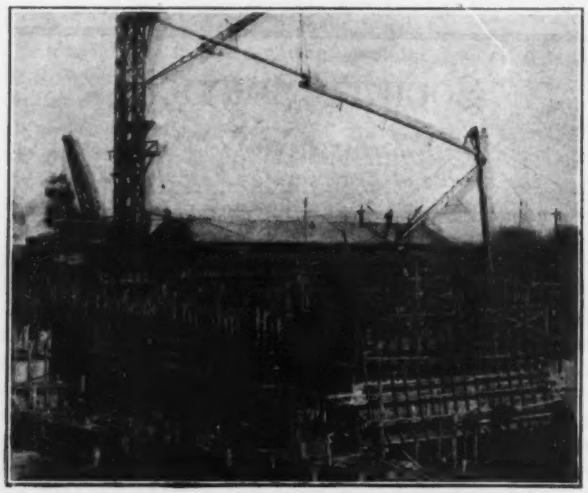
HINTS FOR THE CONTRACTOR

DETAILS WHICH SAVE TIME AND LABOR ON CONSTRUCTION WORK

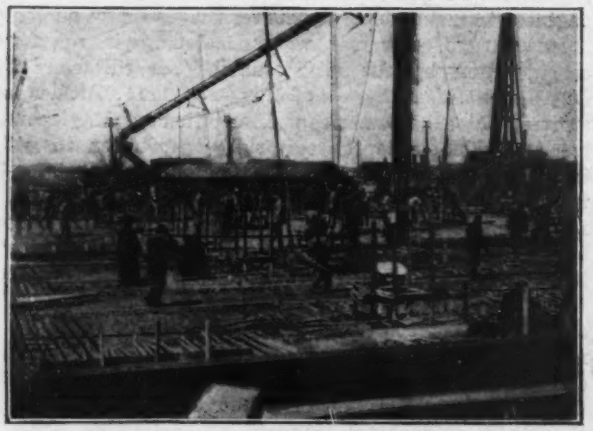
Forty-Five-Hundred-Yard Concrete Boiler Room Mat Laid Continuously

BY H. S. HUNT
Fargo Engineering Co., Jackson, Mich.

THE placing of 4500 cu.yd. of concrete was accomplished in a continuous run at a large power plant in Detroit, Mich.; the concrete formed a foundation mat for the boiler room and covered an area of 115 x 150 ft. and was 7 ft. thick. On account of the great amount of reinforcing steel required for use as shear bars at each location of boiler room columns it was not considered advisable to use the trestle system for placing the concrete. The method shown in the photograph, which is similar to that described in the article on "Sink 7700-Ton Drop Shafts to Exact Line and Grade by Dredging," in *Engineering News-Record* of Sept. 27, 1917, p. 593, was finally adopted and found entirely successful.



CENTRAL POLE AND REVOLVING SPOUT SYSTEM ARRANGED FOR CONTINUOUS CONCRETING



SHEAR STEEL BEING LAID IN ONE SECTION WHILE CONCRETING IS DONE IN OTHER SECTIONS

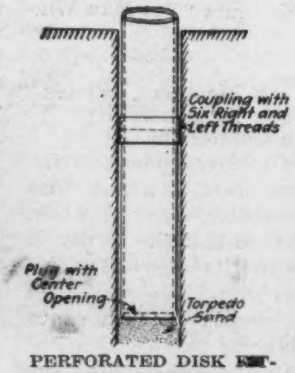
The layout consisted of the usual concrete tower and a wooden pole erected at the center of the mat and guyed by nine ¾-in. steel cables. A set of ½-in. rope falls was fastened to each guy at a uniform distance from the top of the pole. The main spout from the concrete tower was fastened to the top of the pole and discharged into a movable spout, having the upper end attached to the spouting system near the pole, while the lower end was supported by the rope falls. A second swiveling spout was provided at the lower end of the movable spout, so that all points of the mat could be reached.

The process of concreting was carried on continuously, the spout being moved about the pole as a center by attaching the two adjacent set of falls, and pulling in on one while slacking off on the other. In this way the spout could be moved over practically a complete circle, the concrete being placed to a uniform depth throughout the movement. This circular movement was continued until the full depth of 7 in. had been concreted.

Three 8-hour shifts worked on the job, and on account of the method adopted there were no delays occasioned by changing trestles, etc. As shown in the illustration, the method allowed the placing of the shear reinforcement steel in one section while concreting was being done in others.

Sixteen-Inch Cast-Iron Well Casing Sunk by Floating

MORE than 500 ft. of 16½-in. cast-iron well casing was successfully sunk at the Chicago stockyards plant of Miller & Hart, Inc., by plugging the bottom and lowering in a water-filled hole to reduce the weight by flotation. The process is a modification of a process for cast-iron casing deep wells developed by the Whitney Well Co., Chicago, contractors for well drilling, and is being used when longer strings of casing have to be sunk. This process consists, as shown by the sketch, of filling the drilled hole with torpedo sand or similar material, resting the pipe, plugged with a perforated disk, on the sand, and pumping the sand out to let the casing settle gradually.



PERFORATED DISK SET-TED IN PIPE

Cast-iron casing, with cast couplings of semi-steel, of the size used at the stockyards well, weighs about 120 lb. per foot. Its advantage is its resistance to corrosion as compared to steel casing, and its disadvantage is its greater weight. This great weight has been regarded in the past as an insuperable obstacle to its general use, so that the examples here noted of successful sinking record an important advance in deep-well work. Cast pipe requires a straight hole since, unlike steel casing, it will not flex and follow a hole out of true. The stockyards work, therefore, was unique in the perfection of the drilling as well as in the use of cast pipe of large diameter.

The sinking was done with a standard oil-well rig. Through the surface, about 60 ft., a 24-in. hole was used, then a 19-in. hole through limestone and shale to 557 ft. This was the portion cased with the 16½-in. cast pipe. Between 990 ft. and 1040 ft. a soft layer was cased with 12-in. pipe. The remainder of the 1621 ft. of the well was uncased.

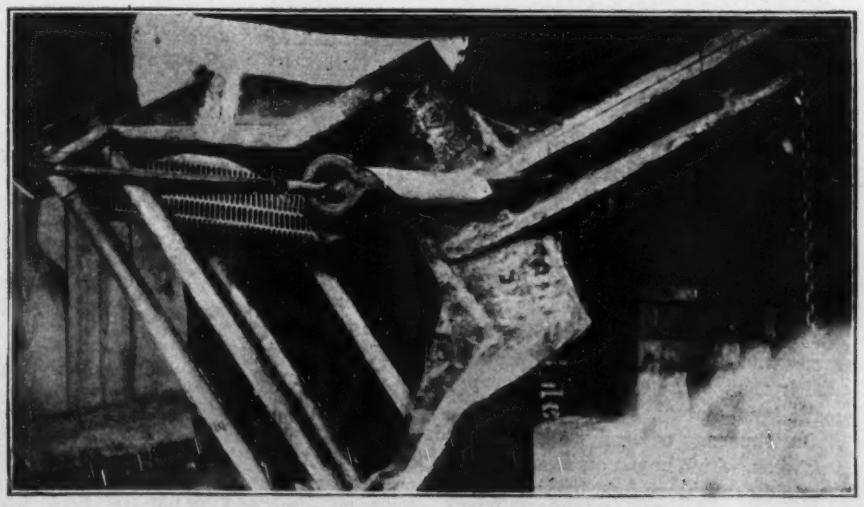
Broken Power Arm of Clamshell Dredge Bucket Welded on Job

By G. W. McAlpin
Point Pleasant, W. Va.

A DIFFICULT weld of a break in a cast-steel power arm of a clamshell dredging bucket was recently made by use of the oxyacetylene welding apparatus. The work was done by the blacksmith at Dam No. 25 on the Ohio River, now under construction by the National Contract Company.

The power arm was broken during the winter, while the bucket was receiving very severe usage. Owing to possible delay in getting a new arm, it was decided to weld the old arm at the job. The edges of the break were trimmed back with a cold chisel to an angle of about 45°, forming a V-shaped trough, and were brought together by the rig as shown in the photograph. One-inch bolts, passing through pipe spreaders, and a clamp held the broken parts together. A metal basket, made from sheet iron suspended under the break, held a charcoal fire for heating, and air pressure from the blacksmith forge blower was applied through a section of pipe.

When the edges of the break had reached the proper temperature, the fire was cleaned away from the top and the addition of material started by the fuse of the welding apparatus. New material was added until the entire trough space containing 29 cu.in. was filled. As soon as the weld was completed a small charcoal fire was placed around it, and the whole was covered with several sheets of asbestos and allowed to cool gradually.

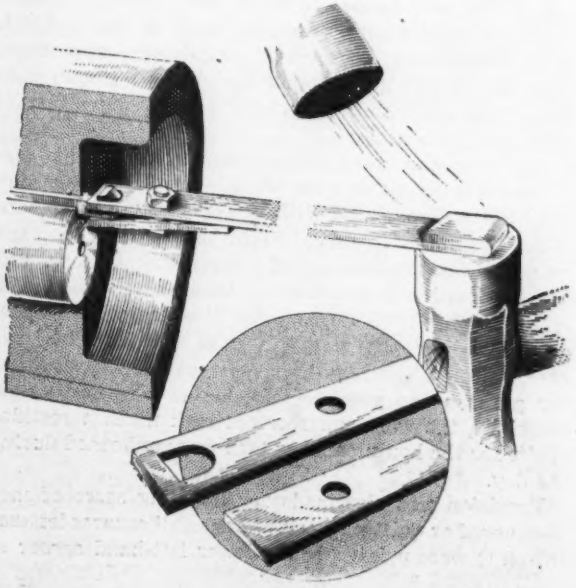


BROKEN POWER ARM CLAMPED, AND READY FOR WELDING

The welded arm has now been in use for some time and has proved entirely satisfactory. Besides the great saving in time and freight, it is estimated that at least 50% of the cost of a new arm was saved by welding on the job.

Use Extension Clamp to Draw Shaft Keys

AN EXTENSION clamp, designed to loosen and draw pulley keys from inaccessible locations, described by W. A. Cooil in a recent issue of *Power*, is shown in this drawing. The device extends the gib-head to a working position. The clamp as described and illustrated is easy to make and use.



KEYS EASILY LOOSENED WITH EXTENSION CLAMP

In the particular instance described, the extension bar and clamp were made of ¼ x 2½-in. material. Holes were

punched for the gib-head and clamping bolt, and the outer end bent over to form a driving head. Three sharp blows with a 10-lb. hammer removed the key.

Pass-Time Card Prevents Disputes Over Time Shortage

By John T. Sullivan
Covington, Ky.

A TIME card handed in every morning and received back every night by each workman on the East Side High School work at Cincinnati regulated tardiness and made arbitration of time shortage claims a simple problem. One card, which is printed on stiff paper, served each man for a week.

The hour was noted when each man handed his card to the timekeeper each morning. Tardiness was thus observed and regulated without opportunity for debate. When the workman quit at night he took back his card, on which the timekeeper had entered the hours worked. If any question of shortage of time arose it was arbitrated at once. This eliminated disputes, which, under systems where the workman does not keep his own card, arise on Saturday over shortages of time charged for perhaps the previous Monday or Tuesday. Substantially, the workman received each night a rectified credit for the hours of labor that was performed during the day.

Provision was also made for handling cases of men discharged or quitting work. Two small squares lettered D and Q were printed in the lower left-hand corner of

TELEPHONE NORTH 201 — ROOS BROS.—TIME CARD — 2814 TO 2824 STANTON AVE., W. H.

NAME Stevens Henry — WEEK ENDING June 28, 1917

NO. 48

RULES: 1 EMPLOYEES MUST CARRY THEIR OWN CARDS, AND HAVE THEM MARKED AT END OF EACH DAY. ALWAYS HAVE CARDS MARKED WHEN LEAVING JOB. CARDS MUST BE IN OFFICE FRIDAY TO GET WAGES SATURDAY AT 4 P. M. WHEN DISCHARGED GET WRITTEN ORDER FROM FOREMAN FOR WAGES.

FRI		SAT		MON		TUES		WED		THUR	
JOB NO.	HRS	JOB NO.	HRS	JOB NO.	HRS	JOB NO.	HRS	JOB NO.	HRS	JOB NO.	HRS
292	9	292	5-	292	9	292	9	292	9	292	9
DAILY TOTAL	9	DAILY TOTAL	5-	DAILY TOTAL	9	DAILY TOTAL	9	DAILY TOTAL	9	DAILY TOTAL	9

TOTAL HOURS 50- RATE PER HOUR .30 TOTAL AMOUNT $ 15.15

D Q FOREMAN

PASS CARD DESIGNED TO ELIMINATE DISPUTES

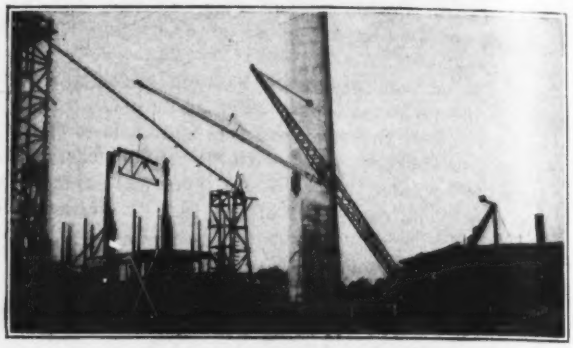
each card. If the workman quit, the timekeeper would cut out the square lettered Q, file the card, and hold the man's wages until the following Saturday. In case, however, the man was discharged he went to the timekeeper and received his card, then returned to the foreman, who cut out the D-square and signed the card, which thus became an order for payment, which was made immediately.

On Thursday of each week new cards for the following week, which began on Friday, were given to the men. The old cards were held by the timekeeper and the time on them figured for the Saturday payroll. The contractors for the East Side High School were Roos Bros., Cincinnati.

Excavator Erects Structural Steel With False Boom

By H. S. Hunt
Fargo Engineering Company, Jackson, Mich.

A DRAG-LINE excavator equipped with an auxiliary boom, as shown in the illustration, was used to erect the structural steel for a steam power plant at Battle Creek, Mich. When the erection of the structural steel was started, consideration was given to the best



EXCAVATORLIFTING STEEL TRUSS INTO POSITION

method of handling this work without interference with concreting operations within the power house walls, and the method shown was finally adopted for placing the steel work on the interior walls.

A 60-ft. cedar pole was rigged up as an auxiliary boom, the load line running from the end of the pole over the pulleys at the end of the steel boom and thence to the hoisting engine. The location of the pole with reference to the steel boom could be changed by means of a second line rigged as shown. Through the use of this arrangement it was found possible to reach all the steel work on the division walls, thus making it unnecessary to use a gin pole. The steel columns on the outside walls and the steel roof trusses were placed as the excavator backed away.

Irrigation In Imperial Valley, 1913-17

Irrigation by Imperial Water Co. No. 1 in the Imperial Valley, California, during 1917, covered 113,503 acres. The acreage of various crops, the total and average volumes of water used and the duties in acre-feet for the years 1913-17, as given in the annual report of Ray S. Carberry, superintendent, follow:

	1913	1914	1915	1916	1917
Total acreage of crops	101,796	105,902	108,224	105,100	113,503
Alfalfa	59,279	57,396	51,797	44,702	35,790
Barley	19,257	17,514	20,363	12,400	9,834
Corn	12,933	10,948	22,145	18,864	27,360
Cotton	4,741	12,114	5,179	20,162	25,765
Miscellaneous	1,190	2,636	1,677	1,334	3,660
Melons	3,125	4,025	4,480	4,702	7,440
Vineyards	910	908	903	939	954
Asparagus	361	361	332	514	424
Trees	.....	.....	967	1,209	1,491
Beans	.....	.....	381	274	348
Wheat	.....	.....	.....	.....	437
Water delivered, acre-feet	337,349	358,579	336,435	350,582	364,578
Duty of water, acre-feet	3.314	3.386	3.109	3.335	3.212
Cost of water, total	$198,948	$191,266	$179,185	$170,349	$193,395
Per acre-foot, cents	58.9	53.3	53.3	48.6	55.0

Labor costs in 1917 were $148,162, as compared with $132,949 in 1916, although only one more man was employed—175 men in 1917 and 174 in 1916, based on a 300-day year.

NEWS OF THE WEEK

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

Quota of Engineer Officers Not Yet Complete

Still Ample Chance for Qualified Engineers to Become Captains or Lieutenants

Engineers between the ages of 32 and 42, qualified physically and mentally to take up the arduous duties of a pioneer engineer officer in the field, are still wanted for captains and first lieutenants in the regiments of the United States Army. Since the primary call for these men, which was given in detail in *Engineering News-Record* of June 13, p. 1150, applications for commissions have been reaching the Chief of Engineers in great numbers. The quota of selected men is not yet full, however, and engineers who are in a position to accept such commissions are being urged to offer themselves to the Government.

How to Apply

The qualifications are an acceptable engineering training and experience, and a physical condition satisfactory to the medical officers of the Army. Applicants should write to the Chief of Engineers, United States Army, Washington, for blanks to be filled out. If accepted for examination they will be notified when to appear before a traveling examining board, which is now making a tour of the country.

The first call stated that men between the ages of 32 and 36 would be accepted as first lieutenants, and between the ages of 36 and 42 as captains. It is now announced that there is an undue proportion of applications for the rank of captain, so the Office of the Chief of Engineers has allotted the limited number of vacancies in that grade to the various sections of the country, roughly on a population basis. It is stated, however, that while most of the existing vacancies are in the grade of first lieutenant, the organization of a great number of additional regiments is contemplated in the immediate future, and by the time candidates accepted now finish their training camp course a considerable number of additional vacancies in the grade of captain will be available for the promotion of those first lieutenants who make the best showing at the training camp.

Men whose applications are accepted by the examining board will be immediately commissioned as captains, or first lieutenants, as the case may be, in the United States Army, and will be detailed to the Engineer Officers' Training Camp at Camp A. A. Humphreys, on the Potomac River below Washington.

(Concluded on p. 247)

Contractors Take Steps To Create National Association

Progress Since Atlantic City Meeting Recorded in Formation of Committee Containing Many Big Construction Men

Action looking to creation of a national federation of contracting interests has followed fast on the informal meeting of contractors (noted editorially on p. 157 of this journal last week) who attended the convention of building industries at Atlantic City July 15 and 16 last. An executive committee representing many of the strongest firms and organizations of contractors in the country has been formed, and is expected to meet in the near future to develop completed plans for the immediate establishment of a national association of general contractors.

The meeting in Atlantic City, at which were present about 25 contractors, representing as many contractors' organizations ranging from New England to the Pacific coast, appointed a temporary executive committee to investigate the possibility of a national organization and take steps looking to its formation. Funds were provided for the activities of the committee, and its chairman was empowered to enlarge the body by inviting the participation of prominent firms and organizations which were not represented at the Atlantic City meeting.

The committee, including those originally appointed and those invited to join, is organized as follows: Chairman, D. A. Garber, New York; secretary, H. D. Hammond, managing editor of *Engineering News-Record;* members, Noble F. Hoggson, Hoggson Bros., New York; T. T. Flagler, the Flagler Co., Atlanta; J. W. Cowper, the John W. Cowper Co., Buffalo; Norman H. Mayo, the Aberthaw Construction Co., Boston; M. D. Smith, A. J. Smith Construction Co., Detroit; E. J. Thomas, D. D. Thomas & Son, Memphis; George Watson, the Watson Co., Dallas; C. P. Massard, Central States Association of Building Contractors; C. W. Gompertz, president General Contractors' Association, San Francisco; Leland H. Ross, P. Sanford Ross, Jersey City; W. A. Rogers, Bates & Rogers Construction Co., Chicago; S. L. May, National Contract Co., Evansville, Ind.; Ronald Taylor, president Building Trades Employers' Association, New York; A. P. Greensfelder, Fruin-Colnon Construction Co., St. Louis; F. L. Cranford, president General Contractors' Association, New York; George A. Glover, New Orleans; Edward A. Steele, William Steele & Sons Co., Philadelphia; Dewitt D. Barlow, Atlantic, Gulf & Pacific Co., New York; and John R. MacArthur, president River and Harbor Contractors' Association, New York.

With the men named, it is believed this committee will include representatives of most of the existing organizations of contractors, in addition to which a number of strong local associations which sent delegates to Atlantic City, notably those in Pittsburgh and Cleveland, are already interested in the movement.

As a basis of discussion at the meeting of the committee to be called early this month, a tentative plan has been submitted to its members which proposes that the membership of the national association shall be composed of existing contractors' organizations of a regional, sectional or local character, and that individual firms shall be admitted to membership only where there is no organization at present in the territory. It is tentatively proposed that a national convention shall be called at which permanent officers and an executive committee shall be elected. When permanent organization is perfected, those interested in the movement contemplate opening an office in Washington and putting forth every effort to gather information, organize the contracting field to assist the Government, and to solve pressing problems that will confront contractors after the war.

Railroad Administration to Protect Short Lines

The Director General of Railroads has created a short line railroad section under the supervision of the director of the Division of Public Service and Accounting. E. C. Niles, chairman of the New Hampshire Public Service Commission, and president of the National Association of Railway and Utilities Commissioners, has been appointed manager of the new section. This section will be charged with the duty of securing to the short line railroads not under Federal control fair divisions of joint rates with roads under Federal control, a reasonable car supply and protection against any undue disturbance in the routing of traffic.

War Department Centralizes Purchasing Control

Each Branch of Army to Have Separate Jurisdiction Over Purchase of Designated Supplies

Organization of the centralized purchasing scheme whereby the General Staff controls the buying of all commodities and supervises all contracts for the Army is rapidly progressing. Already assignment of purchases of a number of commodities has been made to the several branches of the War Department, and boards of review are passing on all contracts in order to insure uniformity of contract control and provisions. The general administration of the scheme is under the direction of Brig. Gen. Hugh S. Johnson, head of the purchase and supply branch of the division of purchase, storage and traffic of the General Staff of the Army.

In the past the various branches of the department have been buying their respective commodities through their own purchasing agencies, often bidding against one another for the same goods and frequently paying several different prices for the same article. The General Staff brought together a committee of representatives of the various purchasing agencies, and this committee is now engaged in standardizing the commodities needed and assigning to one branch of the department the purchase of each commodity. This standardization has progressed to the point indicated in the accompanying table, which shows the name of the branch intrusted with the purchase of about 150 items so far agreed upon. Others are being added to the list each day.

Thus, reinforcing bars, regardless of their use or of the branch that uses them, are purchased by the Construction Division according to specifications laid down by that division. Any other branch requiring reinforcing bars makes a requisition on the Construction Division for the required amount. More than 70 per cent. of the articles bought by the department are now being purchased under this system.

A further extension of purchasing is the establishment of boards of review which have to pass on all contracts before they become valid. Boards of review have been established in each of the eight purchasing bureaus; that is, quartermaster, construction, ordnance, engineers, signal, aircraft production, medical and chemical and war gas. Each board consists of men representing purchasing, finance, production and contracts. This board passes first on all contracts more than $5000, second on all cost-plus contracts and third on all formal competitive bidding contracts where the contract is not awarded to lowest bidder by the local officer. It sits every day and goes over each contract—those from remote points by telegraph if necessary—and approves only those which are in accordance with the rules laid down by the main committee on purchases or which seem to be at prices in accordance with the state of the market.

In addition to these departmental boards there is a superior board of review, consisting of General Johnson, a representative of each minor board and Max Thelen, who is surveyor of contracts. This superior board passes on large questions of purchase and contract, lays down the general rules of purchase and acts as a court of appeals from the lower boards. In general, any dissatisfied prospective contractor has the right of appeal to the superior board.

In standardizing the work of purchasing, this superior board is making a number of reforms. For instance, it is preparing a card index of all purchases made by the War Department, according to a punch card system, whereby the prices and contract requirements can be told for all previous purchases at a glance. Thus, the board can keep tab on the contracts submitted, as to price, quality, delivery, etc. The superior board, too, is deep in the study of contract forms, so as to standardize the various specifications and contracts and to protect the Government as to price, terms and conditions. The cost-plus form of contract is particularly under scrutiny just now and will probably be standardized in the near future.

More than 3000 separate purchase transactions are now passing through the War Department each day, to say nothing of the construction contracts that also come under the jurisdiction of the boards of review. The perfecting of the present system is expected not only to insure more efficient purchasing on the part of the Government, reducing as it does the multiplicity of purchasing and inspecting effort, but also will be of material advantage to the manufacturers, who for any one product or group of products will have to deal with only one agency in the War Department.

QUARTER-MASTER	CONSTRUCTION	ORDNANCE	ENGINEERS	SIGNAL	AIRCRAFT PRODUCTION	MEDICAL	CHEMICAL AND WAR GAS
Automobile Drive Chain	Reinforcing Bars	Chrome and Ferro-Manganese Alloys	Arc Search Lights	Electric Wire	Aeroplane Cloth	Surgical Dressings	Elastic Tape
Ice Boxes	Cement	Ammonium Nitrate	Chain	Radio Equipment	Brass and Copper Tubing	Surgical Needles	Horse Masks
Burlap	Clay Products	Artillery Chain	Paint Containers	Telephone and Telegraph Equipment	Electric Wire and Cable	Medical Thermometers	
Non-Skid Chains	Electrical Equipment and Supplies	Barometers	Gantry Cranes		Clocks		
Cotton Cloth	Electric Wire for Heavy Power	Dry Batteries	Locomotive Cranes		Aviators' Clothing		
Cotton Goods	Refrigerating Equipment	Blast Furnace and Steel Mill Products	Paint Driers		Compasses		
Cotton Rope	Sand and Gravel	Cartridge Cloth	Electric Gas Generator Sets		Wood Distillates		
Silk Fabric	Rough Hardware	Coal Gas Products	Enamels		Gages, Oil, Air and Gasoline		
Rubber Goods	Heaters, Room Heating Equipment and Supplies	Coal Tar Products	Gas Engines		Steel Hangars		
Woolen Rubber Goods	Plumbing Equipment and Supplies	Cotton Linters	Mechanical Rubber Goods		Linen Fabric for Balloons and Aircraft		
Jutes	Roofing Material	Forging Equipment	Japans		Thermometers		
Leather	Sprinkler Systems	Hull Fiber	Lacquers		Spar Varnish		
Linen	Ventilating Equipment	Flash Lights, Dry Cell	Mineral Spirits				
Manila Rope	Water Supply Equipment and Fixtures	Lanterns	Paint				
Needles	Structural Steel	Nitrates	Steam Shovels				
Woolen Goods		Tin	Turpentine				
		Pig Tin	Varnishes				
		Plate Tin	Linseed Oil				
		Platinum	Railway Equipment				
		Sodium Nitrate					
		Stop Watches					

Signal Corps Wants Men for Photographic Work

The Signal Corps announces an urgent need for a large number of men to engage in the compilation of a pictorial history of the war. About 60 more lieutenants and as many sergeants, first class, are to be selected for this work; and for a short time, until the immediate needs are met, some commissions will be given to men direct from civil life whose experience is ample to justify this procedure. Other men will be sent temporarily to the Signal Corps School of Photography at Columbia University, New York City, where they will be taught, not how to take pictures, but rather what kind of pictures to take. Many of the men commissioned will become staff officers of army divisions and as such will be in charge of the work of making a pictorial history of the activities of that division from the time of its organization through its active war service.

The successful newspaper photographer represents most nearly the type of man needed. That is to say, he must have a "nose for news" in addition to being able properly to set and expose his camera. A military photographer must possess a generous amount of initiative and originality, for he will have to act as his own director and dig up the type of picture that really tells the story.

The Signal Corps states that appointment will depend almost entirely on a man's previous experience. Application for service can be made and full particulars obtained by addressing the Office of the Chief Signal Officer, Photographic Section, Arcade Building, Washington.

Quota of Engineer Officers Not Yet Complete

(Concluded from page 245)

While there they will receive the pay and allowances of their grade, although, of course, as in all officers' training camps, they will be considered as privates and be classed with all the other student officers. They will be required only to provide themselves with the uniforms of their ranks, but while at camp will be provided by the Government with working uniforms.

ALLOWANCES FOR OFFICERS IN CAMP

Since April of this year the commutation of quarters, fuel and light has been extended to all officers serving abroad and to all officers serving in this country in the field who maintain separate abodes for dependent wives, minor children, etc. This includes officers at training camps, cantonments and those occupying temporary quarters on permanent reservations or at Army posts. According to this ruling, a major receives $60 per month commutation of quarters and a fuel and light allowance of from $6 to $20 per month, depending on location, climate and amount of space occupied. This, of course, is in addition to his salary. A captain similarly receives $48 and from $5 to $18 fuel and light allowance; a first lieutenant $36 and from $5 to $15; a second lieutenant $24 and from $4 to $12. This brings the salary of a married captain to about $3000 per year, and of a married first lieutenant to about $2500 a year.

Opportunity for Engineers in Artillery School

Artillery officers are needed in the United States Army, and a field artillery central officers' training school for civilians between 20 years and 8 months and 40 years of age, and for enlisted men of the army, has been established at Camp Zachary Taylor, about six miles southeast of Louisville, Ky. Engineers are peculiarly well qualified for modern artillery service, and it is hoped that a number of them will become candidates for the school.

Civilians wishing to enter the school will make application for a blank for entrance to the field artillery central officers' training school. After the form is filled out, designation to a medical officer will be made and if the applicant passes the examination he will be notified of his acceptance and ordered to the camp. While at the camp he receives the pay of a private, first class, $33 a month, and upon graduation will either be commissioned as second lieutenant or will be appointed to the grade of sergeant and designated officer-candidate. He will then be sent to replacement depots and commissioned as soon as vacancies occur. While at camp a man with a wife must allot not less than $15 a month to her, to which the Government adds $15 if she is childless, $25 if there is one child, $32 if there are two children, and $5 a month for each additional child. The Government pays all expenses of the man while at camp.

The department particularly wishes to get older men of mature judgment, and states that such men need not hesitate to enter the school because on graduation they cannot be commissioned above second lieutenant, as promotion will be by selection and should be rapid if they demonstrate ability.

The call for candidates says that the field artillery is in need of officers who have scientific and technical education, but this is by no means a prerequisite to the selection of a candidate. It is essential, however, that every candidate should now have or be in a position to readily recall a thorough understanding and working knowledge of arithmetic, algebra and plane geometry. A knowledge of trigonometry is desirable.

All applications should be addressed to Field Artillery Central Officers' Training School, Camp Zachary Taylor, Louisville, Ky.

Flushing Bay Yard Launches First Concrete Barge

On July 27, the first concrete barge built by the Fougner Concrete Shipbuilding Co. was launched at the company's yard, Flushing Bay, New York City. It is a bulk-oil carrier, the "Socony 200," built for the Standard Oil Co. of New York. The vessel is 98 ft. long, 32 ft. broad by 9 ft. 9 in. deep amidships and 10 ft. 3 in. deep at the ends, drawing 3 ft. 10 in. light and 9 ft. with a cargo of 370 tons.

Special interest attaches to the event because it was the first successful end launching of a concrete vessel in this country. Furthermore, the "Socony 200" is the first concrete bulk-oil carrier built in America.

The company started work early in March. At present six ways for barges are in operation. A second yard, near the first, was started later, and here ways have been completed for a 3500-ton concrete vessel for the Emergency Fleet Corporation. Four ways will be built, capable of taking vessels of 7500 tons dead-weight carrying capacity.

Herman Fougner is president of the company. H. A. Hyman is superintendent of construction, in charge of operations at the Flushing Bay Yard.

Training Schools For Military Instructors In Colleges

The War Department has obtained the services of Dr. R. C. McLaurin, president of the Massachusetts Institute of Technology, as educational director for the new army training corps, which is being created under the auspices of the department's committee on education and special training. This announcement is made in Washington coincident with the statement that the work of the corps is now in full swing, and that three summer camps were opened July 18 for professors and advanced students in colleges who will take part in the student training corps next fall. Also, the committee has called three conferences, to formulate detailed regulations, under which the army training corps shall be administered.

The three summer camps are established at Plattsburg, N. Y., Fort Sheridan, Ill., and Presidio, Cal. Three thousand men have been enrolled in each for a period of 60 days, the purpose being to instruct members of faculties and students so they may be able to assist in giving military instruction at colleges. The camps are being operated under the direction of the commanders of the different military divisions in which they are located. The schools have been asked to furnish one instructor for each 200 students and one student out of each fifteen. The schools are reporting direct to the commanders of the military divisions of the Army. The camps are reported to be well on the way to having full quotas. The students and professors are on active duty as privates enrolled in the army under a special 60-day enlistment, with the pay of privates. The expenses for traveling are paid, although it is stated that the schools are at liberty to pay their instructors out of their own funds, and do so in many cases

The conferences called by the committee to formulate detailed regulations under which the army training corps shall be administered will bring together a large number of college men, as the guests of the committee. One conference is to be held at Presidio, Cal., Aug. 23, another to be held at Fort Sheridan, Aug. 30, and the other to be held at Plattsburg, Sept. 3.

Spring Valley Wins Right to Collect Meter Rates

The Railroad Commission of California has given the Spring Valley Co. of San Francisco authority to collect meter rates on all metered services. This relieves what is believed to be the unparalleled situation of a water company having meters in service without being allowed to base charges on meter readings. The commission has stated its belief that metering is the only means of conserving the present supply, and is to issue an order covering rates as soon as the company engineers can confer with the commission and agree thereon.

Allen Hazen stated in the course of the hearing before the commission that the company is now selling more water than its sources are capable of producing. During the past year the rainfall has been only 41% of normal, and Mr. Hazen pointed out that should a third dry year follow the water reserves of the company would be exhausted. At the present rate of consumption, he said, the company has only a 330-day supply in storage. The domestic consumption registered by meters is approximately 11,000,000 gal. per day, but as flat rates only are collected Mr. Hazen estimates that approximately 2,000,000 gal. per day are wasted.

The schedule of rates as proposed by the water company and accepted by

the city was worked out with the intention of bringing the company the same revenue as is produced by the present flat rates. The proposed rates are in the form adopted by the New England Water-Works Association, graded as follows:

Kind of Service	Rate Per 100 Cu.Ft.	Quantity Per Month, Cu. Ft.
Domestic	24	Up to 33,000
Intermediate	20	3300 to 33,000
Manufacturing	16	Over 33,000

The meter charge, in addition to the foregoing, would range from 75c. per month upward, varying with the size of the meter. It is believed that under the proposed rates 10% of the consumers, designated as water wasters, would be hit hard, 40% would be affected by a slight increase, and the other 50% would get lower rates. In the event that these rates produce more revenue than the flat rates, the excess is to be disposed of by order of the railroad commission.

Selling water by meter measurement in San Francisco was temporarily suspended early in 1917 by order of the State Railroad Commission, on the ground that the rates then being collected had no legal status because they had been fixed by the city authorities after jurisdiction had passed to the commission. (See *Engineering Record* of Jan. 20, 1917, p. 125; *Engineering News* of Feb. 15, 1917, p. 273.)

Seattle Asks $5,500,000 Power Development

Asserts Shortage by End of Year Will Be 58,000 Horsepower Unless Present Units Are Increased

Seattle has petitioned the Capital Issues Committee for approval of an issue of $5,500,000 light and power bonds for the construction of a hydro-electric power plant on the Skagit River, which, it is stated by the petitioning committee, is necessary at this time because there is no surplus power available in the Seattle district, regardless of place or manner of generation, and the actual condition of the city's present hydro-electric plant is such that there is likelihood of failure. The petitioning committee, composed of Ole Hanson, mayor of Seattle; C. B. Fitzgerald, chairman of the finance committee; Hugh M. Caldwell, corporation counsel, and R. H. Thomson, formerly city engineer for Seattle, appeared in person before the Capital Issues Committee for the purpose of pointing out that the construction of additional power facilities at this time is essential to insure an adequate and continuous supply of electrical power to Seattle, due to the greatly increased power demands of the district, the depreciation of the present hydro-electric plant at Cedar Falls on the Cedar River and the possibility of the failure of Cedar Lake Dam, which would endanger the city's water supply from Cedar Lake.

The report of the petitioning committee points out that the maximum usable power from hydro-electric sources, including the White River plant, the Snoqualmie plant, the Electron plant and the Cedar Falls plant, is approximately 96,000 hp. and that the maximum usable power from steam which can be produced under present conditions in the Seattle district is approximately 41,000 hp., making a total of available usable energy of 137,000 hp., as against a total maximum demand during 1917 of approximately 128,000 hp., leaving a theoretical surplus of only 9000 hp. Since this time and up to July 1, 1918, additional demands for power have been made upon the municipal plant and contracts signed for 17,000 hp. and notification has been given to the management that an additional supply of 44,000 hp. will be required in the near future. To furnish this amount of current to customers, it is stated that an additional installation to develop approximately 67,000 hp. will be required, and that if this is not done there will be a power shortage at the end of the year amounting to 58,000 horsepower.

"Faith" Starts for the Atlantic

The concrete freighter "Faith" recently left San Francisco with a cargo of lumber, bound for the west coast of South America. There she is to take on a load of nitrate and go via the canal to a northern Atlantic port.

ENGINEERING SOCIETIES

Calendar

Annual Meetings

AMERICAN INSTITUTE OF MINING ENGINEERS; 29 West 39th St., New York City; Sept. 2, Denver, and Sept. 3, Colorado Springs, Col.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS; Pittsburgh; Sept. 9-13, Baltimore.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS; 204 East Walnut St., Bloomington, Ill.; Oct. 2-4, Buffalo, N. Y.

AMERICAN PUBLIC HEALTH ASSOCIATION; 126 Massachusetts Ave., Boston, Oct. 14-17, Boston.

The Engineers' Club of Mobile, Ala., was organized at a meeting of members of the profession held July 23. L. W. Duffee, special engineer for the Gulf, Mobile & Northern R.R., was chosen as the first president of the society. Other officers chosen were: vice-president, Wright Smith, city engineer of Mobile; secretary, R. H. Pitard, assistant chief draftsman, Mobile Shipbuilding Co.; treasurer, Walter W. Toxey, also of the Mobile Shipbuilding Co. Many members of the profession attended the organization meeting of the society, membership in which is open to professional engineers in the civil, mechanical, electrical and architectural branches. As stated by Mr. Duffee at the meeting, the coming of the shipbuilding industry to Mobile has brought with it a large number of members of the engineering profession, leading to the organizing of a local engineering society.

The San Francisco Sections of the **American Society of Civil Engineers, the American Society of Mechanical Engineers, the American Institute of Mining Engineers, the American Institute of Electrical Engineers** and the **American Chemical Society** held a joint meeting at the San Franscisco Engineers' Club July 23 to hear A. D. Flinn, secretary of the Engineering Council. Mr. Flinn described the work of the various joint organizations, centering in the Engineering Societies Building in New York City, particularly war-time activities, in which he asked for the aid of Western engineers. A resolution that there be formed in San Francisco a joint council, to coördinate the activities of the five national engineering society sections in that city, was unanimously adopted.

The Northwestern Society of Highway Engineers, the Oregon Society of Engineers, and the **Portland Association of Members of the American Society of Civil Engineers** held a joint meeting in Portland July 13. Following the business session a banquet was held at the Benson Hotel in the evening. The address of welcome was delivered by Herbert Nunn, president of the highway engineering society. R. H. Thompson of Seattle discussed the importance of enacting legislation for the registration of professional engineers.

The Cleveland Engineering Society will hold its first regular meeting for the coming season on Sept. 10, which will be addressed by Alfred D. Flinn, secretary, Engineering Council, New York City, and by W. H. Finley, president American Association of Engineers, Chicago.

PERSONAL NOTES

W. C. CUSHING, chief engineer maintenance of way, Pennsylvania Lines West of Pittsburgh, has been appointed engineer maintenance for the Pittsburgh, Cincinnati, Chicago & St. Louis Ry., the Cincinnati, Lebanon & Northern Ry., and the Lorain, Ashland & Southern R.R., as well as the Pennsylvania Lines West, under the new organization of Federal management.

L. L. BEALL, chief engineer of the Atlanta, Birmingham & Atlantic Ry., has been appointed chief engineer for the Georgia R.R., the Atlanta & West Point R.R., the Western Ry. of Alabama, the Charleston & Western

Carolina Ry. and the St. Louis-San Francisco lines east of the Mississippi River under the new organization of Federal management.

F. W. BALLARD, consulting engineer, Cleveland, who has been commissioner of lighting for the city of Cleveland and who had charge of the city's municipally owned electric light plant, has been appointed special assistant to the vice-president of the Emergency Fleet Corporation, with headquarters in Philadelphia.

W. H. VANCE, engineer maintenance of way, St. Louis Southwestern Ry., has also become engineer maintenance of way for the Louisiana & Arkansas Ry. and the Illinois division of the Missouri Pacific R.R. under the new organization of the Federal management.

M. N. WATSON, road engineer for the State Highway Commission of Kansas, has assumed the duties of W. S. Gearhart, state highway engineer for the commission, during his leave of absence for the duration of the war as captain in the Engineer Officers' Reserve Corps, noted in last week's issue.

R. G. JENCKES, JR., has resigned as assistant engineer for the Indianapolis Water Co. to become associated with the Pitometer Co., of New York City, with headquarters at Wheeling, W. Va.

BERTRAND E. GRANT, division engineer, Board of Local Improvements, Chicago, and past president of the Western Society of Engineers, has been granted leave of absence to enter the service of the Emergency Fleet Corporation at the Hog Island shipyard.

MISS FLORENCE HOLMES, Portland, Ore., who has been appointed to a position in the town planning and housing work at the Puget Sound Navy Yard at Bremerton, Wash., is attached to the office of E. T. Mische, of Seattle, who is at the head of the town-planning division of this project, as noted in *Engineering News-Record* of last week, p. 197. It is said that Miss Holmes is the first woman in the country to receive such an appointment. As a student at Oregon Agricultural College she majored in landscape architecture, her course including surveying and elements of civil engineering. Since her graduation she has designed a memorial gateway that was erected on the Oregon Agricultural College campus as the gift of the senior class.

P. D. FITZPATRICK, valuation engineer and general road master, Central Vermont Ry., has been appointed chief engineer. Mr. Fitzpatrick was appointed valuation engineer in January, 1916, with headquarters at St. Albans. In July of the same year his duties were expanded to include those of general road master as well as valuation engineer.

HERBERT E. HUDSON, division engineer, Board of Local Improvements, Chicago, has been granted leave of absence to become division engineer for the Construction division of the Quartermaster's Department at the Aberdeen proving grounds, north of Baltimore.

A. B. TRUMAN has been appointed division engineer of the New Mexico division, Atchison, Topeka & Santa Fe Ry., with headquarters at Las Vegas, N. Mex., succeeding J. A. Roach, who has entered military service.

L. H. SALTER has been appointed chief of the Bureau of Sanitary Engineering of the new organization created by coördinating the sanitary and health departments of Jefferson County, Alabama, including the city of Birmingham.

LEROY F. WERTZ, for the past seven years assistant engineer for the Board of Park Commissioners of Indianapolis, has been appointed assistant engineer to the Indianapolis Water Company.

RALPH W. EATON, engineer for the Shore Line Electric Ry. system, Norwich, Conn., has been appointed public service engineer of Providence, R. I., succeeding Robert L. Brunet.

M. R. SUMNER, resident engineer for the Jessup & Moore Paper Co., Philadelphia, with headquarters at Wilmington, Del., is to become associated with Fred T. Ley & Co., Inc., contractors and engineers.

R. L. ROWLEY, assistant engineer for the Board of Fire Underwriters of the Pacific, San Francisco, has become engineer for the insurance department of the Emergency Fleet Corporation, United States Shipping Board, at 369 Pine St., San Francisco.

ALLEN G. LINCOLN, division engineer for the Victor American Fuel Co.'s mine at Chandler, Colo., has been appointed assistant district engineer in the Denver district, United States Forest Service. Mr. Lincoln will assume his duties as assistant district engineer Aug. 10.

FRANKLIN THOMAS, professor of civil engineering and chairman of the faculty executive committee of Throop College, Pasadena, Cal., has been appointed assistant engineer under Capt. Charles T. Leads, Los Angeles division engineer for the U. S. Army Corps of Engineers, who is in charge of army construction work along the coast of Southern California and flood control work along the Colorado River.

ARCHIBALD H. ROWAN, assistant to the vice-president, traffic department, New York Central Lines, has been commissioned a major in the Engineer Officers' Reserve Corps.

DAVID C. MORROW, city engineer of Washington, Penn., has resigned to accept a commission as captain in the sanitary department of the United States Engineer Corps.

OBITUARY

ISAAC SHONE, inventor of the sewage ejector which bears his name, died in England June 19. He was born at Brymbo, Wales, near Wrexham in 1856. For many years he maintained engineering offices under the name of Shone & Ault at Wrexham and in London. He was mayor of Wrexham in 1878. His firm coöperated with Dr. Owen Travis in developing the Travis hydrolytic tank, the intermediate stage between the Cameron and the Imhoff tank for the treatment of sewage.

CHARLES ALLEN GOODNOW, vice-president of the Chicago, Milwaukee & St. Paul Ry., since July, 1917, died July 26, after a brief illness in Seattle. Entering railroad service in 1868 with the Vermont & Massachusetts R.R., Mr. Goodnow became superintendent of the New Haven & Northampton R.R. in 1881, and in 1886 was appointed superintendent of construction with the Chicago, Milwaukee & St. Paul Ry., being promoted in 1888 to division superintendent, with headquarters at Dubuque. In 1902 he was appointed general manager of the Chicago, Rock Island & Pacific Ry., and in November, 1903, became general manager of the Chicago & Alton R.R. In 1913 he became assistant to the president of the Chicago, Milwaukee & St. Paul Ry., and had under his charge the electrification of that road from Freeport, Mont., to Deer Lodge, which work was considered remarkable for the rapid progress made and the results achieved in but three years of work. Mr. Goodnow also constructed the Gallatin Valley Ry., a subsidiary of the St. Paul, and was president of that line. Many interesting innovations were made by Mr. Goodnow, such as the use of interlocking plants, English staff machines, the perfection of the manual block system as now in use on the St. Paul, and the introduction of the floating system of handling freight on Puget Sound.

NEWS OF ENGINEERING INDUSTRIES

FOR MANUFACTURERS WHO SERVE ENGINEERS AND CONTRACTORS

Intensive Campaign in Progress To Recruit and Apportion Labor for War Industries

Will Resemble Liberty Loan Drive and Will Show Labor Shortage and Emphasize Need for Maximum Production

On July 29, the Department of Labor launched a nation-wide advertising campaign to lay before the public the plans and methods of the United States Labor Bureau for the recruiting and distribution of unskilled labor. The drive is patterned after the Liberty Loan drives and will emphasize the labor shortage and the necessity for maximum production by every industry throughout the entire nation. A preliminary outline of the employment program of the Government was given in *Engineering News-Record* of June 27, p. 1245.

A survey of the labor requirements and supply is in progress, and the results show the extent of the labor crisis throughout the country. Very few sections, so far reported, have any surplus from which labor may be drawn. When the survey of requirements is finished and the aggregate demand is found, to each state will be assigned a quota representing the common labor to be drawn from among men engaged in nonessential industries in that state. The quotas will be distributed among localities in which employers in nonwar work, including those who are only partially in war work, will distribute the local quotas from time to time among themselves.

The term "indirect war work" does not extend to those plants making supplies which may ultimately be used in war work but which are not being delivered directly to firms producing direct war materials, and such firms will not at present come under this ruling. There has been no attempt to define "unskilled" labor, since it is well understood, but where there is uncertainty in this, as well as in the matter of essential or nonessential war work, the question may be referred to the labor boards for decisions and an appeal from these decisions, if not satisfactory, may be made to the War Labor Policies Board at Washington. All recruiting for labor must be done through the United States Employment Service. Exceptions are made in the case of railroads, nonwar industries and those hiring less than 100 men, but the recruiting in these cases must not interfere with the activities of the official labor recruiting boards, by offering superior inducements, or preventing the transfer of workers urgently needed for war production, or in any way attempting to compete with the Government for labor.

The program will be extended to the skilled classes as soon as the need becomes acute, but strict prohibitions are put upon solicitation to draw skilled labor from one war industry to another or to nonwar work. No restrictions are put upon the hiring of labor that presents itself wholly unsolicited either directly or indirectly, and no cards of dismissal are needed at present.

Employers may make their wants known on blanks that are being distributed through the War, Navy and Labor Departments, the Shipping Board and the fuel administration. These blanks have been sent out, but if they have not been received application should be made to state directors. After filing the application the employer should receive a notice from the employment service informing him of the office or agent especially charged with the filling of his order.

(Concluded on next page)

German Lumber Company Will Help Contractor Build Ships

With the letting of a contract by the United States Shipping Board to the Bates & Rogers Construction Co., Chicago, for eight 2500-ton schooner barges an end comes to an obvious and insidious plan of the Germans to control the Gulf of Mexico from a harbor on the south Florida coast, through the medium of the $3,000,000 German-American Lumber Co. Since 1917 this company owned 150,000 acres of land surrounding St. Andrews Bay and strategically located directly south of the Alabama iron and steel district, but development had been suppressed and the two sawmills were operated only in a desultory manner supplying lumber for export. The only railroad to the bay was forced to condemn all land for right of way.

Since its taking over by the United States alien property custodian, the property and funds have been made available to finance a shipyard of four ways which will require a thousand men to build and as many to operate.

From the headquarters of the company, which was fitted out in fine style for the German directors, masses of propaganda material were taken when the officials were interned.

Business Conditions To Be Compiled and Indexed

Complete Statistics To Be Collected, Correlated and Published by Reserve Board

An index of industrial, business and economic conditions throughout the country, for publication in its monthly bulletin, is the purpose of the Federal Reserve Board announced recently in Washington. Business progress, economic changes and the financial and banking situations throughout the country will be correlated, and a series of indexes inaugurated for the use and guidance of the industries and business.

The board expects to obtain its material from trade journals and commercial organizations, as well as from Federal Reserve agents, state and municipal sources. The information will cover the production, consumption, transportation and prices of commodities and other factors. Changes occurring in the economic and business conditions of the country may be followed. They will include market movements, receipts and shipments of stocks in hand and the prices of leading commodities. From such data an index will be computed to show the changes in volumes of trade, stocks, consumption, etc.

The scope of the undertaking will cover the following topics:

1. Retail and wholesale prices indexed with reference to a specified base. This will include a series of indexes computed by private investigators, such as Dun's, Bradstreet's, the Bureau of Labor Statistics, etc. These have been the subject of a study made by W. C. Mitchell recently published by the United States Bureau of Labor Statistics; the figures will be correlated to compare changes in price, with production and the movement of commodities.

2. Production reports, gathered from reports of various industries, especially the basic industries, such as iron, coal, steel, copper, mining, etc. These will be a basis for producing factors for the correlation of information regarding the quantities of products on hand, in storage or at points of shipment, and the assembling and distributing of output.

3. Railroad data compiled from the reports of the railway administration as to the changes in movement and character of freight, and showing the activity of industries by indicating the extent to which such materials were being demanded and moved in order to supply consumption.

(Concluded on next page)

Labor Recruiting

(Concluded from previous page)

Local quotas will be drawn upon first. Where this is not adequate, other states will be drawn upon, but movements from state to state will be effected with the greatest economy in distance traveled. The distribution from these quotas will be arranged between the state directors, subject to supervision from Washington. The transportation will be paid by the employment service from its "revolving fund" and later collected from the industries for whose benefit it has been advanced.

All the men before leaving their home sections will be examined as to skill and physical condition. Local public health boards will conduct physical tests and all requirements as to vaccination, etc., will be announced and complied with in advance.

The employment service is established throughout the nation and divided into state organizations which in turn are subdivided so as to cover every community.

Rocker End-Dump Truck Operated from Driver's Seat

A 1½-ton end dump body in which the weight of the material supplies the energy for operating it, the control being from the driver's seat, is shown in the accompanying illustration. The operation is accomplished without the addition of power from either the engine or the operator.

The mechanical action is on the rocker principle, and lies in the design of the curvature in the supporting rockers. The employment of this mathematical curve makes the weight of the material in falling perform the work of tipping the body and storing sufficient potential energy to cause it to regain automatically the horizontal position after the load discharges.

The attachment is made for the Ford truck, and is manufactured by the Anthony Co., Inc., Streator, Ill.

Business Indexes

(Concluded from previous page)

4. Banking information such as clearings, deposits and reserves, together with commercial rates of interest and discounts on various loans, and information as to capital and credit, will be compiled. The information and statistics from the office of the Comptroller of the Currency and the Federal reserve system generally, as well as other banking data, will be indexed so that the industries may be able to obtain the information desired.

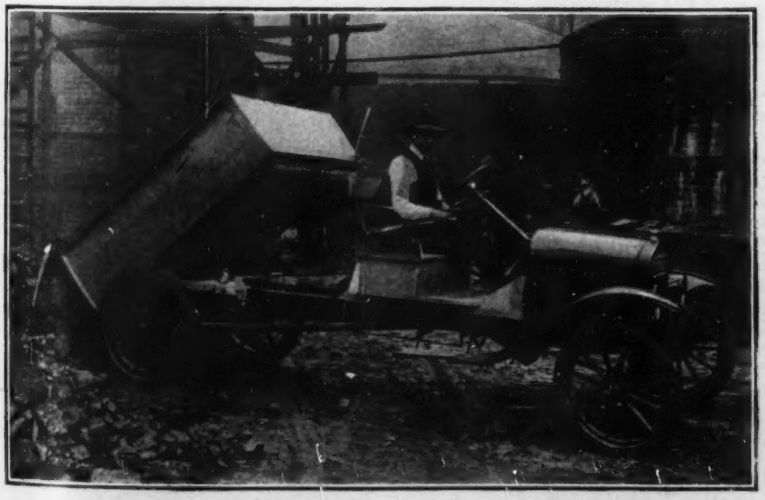
5. Under savings and investments, improvement on the information that has been so far available will be attempted, to show the relations between production and consumption as indicated by savings. This will supply the information regarding the money available for investments and the capacity of the country for the employment of labor.

6. The employment of labor, its extent and distribution at any given time in the various portions of the country will indicate the volume of industry and the purchasing and consuming power throughout the various industrial sections.

The Federal Reserve Board states that the establishment of these indexes is only a step in the eventual development of a complete service of business indexes relating to the condition of the chief industries.

OBITUARY

George Bancroft Adair, president of George B. Adair & Son Co., dealers in general machinery and electrical equipment, Seattle, died recently at his home in Seattle. Mr. Adair organized the Adair Co. in 1912, after having been engaged in the hardware business for many years. He was born at Romulus, N. Y., July 13, 1847.



LIGHT MOTOR TRUCK WITH AUTOMATIC DUMPING DEVICE

BUSINESS NOTES

Joseph Tracy, formerly a racing motorist but later an engineer for various automotive interests, has been appointed consulting engineer to the bureau of oil conservation, United States fuel administration. He will supervise the testing of gasoline and other fuels and their consumption in all types of automobiles.

The Pioneer Asphalt Co. reports that its plant at Lawrenceville, Ill., was burned to the ground July 20. Under present conditions it may be difficult to secure a supply of material for resuming operations. H. B. Pullar is general manager.

W. H. Foster, president of the General Fireproofing Co., has been elected chairman of the Youngstown, Ohio, division of the War Industries Commission.

G. O. House, formerly superintendent of the St. Paul municipal water department, has been appointed manager of the Northern States Power Co., St. Paul, Minn., succeeding P. T. Glidden, deceased.

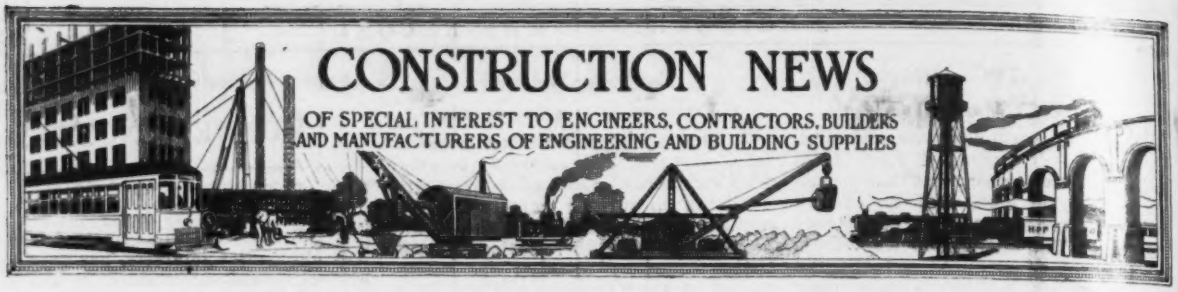
TRADE PUBLICATIONS

The All-American Truck Co., Chicago, Ill., has issued a folder announcing the introduction to the automobile market of the All-American internal-gear-drive one-ton truck.

The Villadsen Bros., Salt Lake City and Ogden, Utah, engineers and contractors, have issued a booklet containing illustrations of the concrete buildings and industrial plants erected in Utah and adjoining territory by that company.

A catalog has been received entitled "Graphic Record Supplies," of specially prepared material sold by the Educational Exhibition Co., Providence, R. I. It illustrates graphic charts and supplies for use of executive sales managers, advertisers, draftsmen, educators, engineers, etc.

The Wellman-Seaver-Morgan Co., Cleveland, Ohio, has issued Bulletin No. 10, dated July, 1918, on the W-S-M Coke Oven Machinery. It has six pages of 8½ x 11 size, and describes and illustrates this class of heavy machinery.


CONSTRUCTION NEWS
OF SPECIAL INTEREST TO ENGINEERS, CONTRACTORS, BUILDERS
AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES

Construction Material Prices Subject of Several Important Meetings and Conferences

Indications That Coal Production and Food Supplies Are Meeting the Crisis Will Probably React on Prices

Several important meetings and conferences on building materials have drawn marked attention to the problems of prices, supply and demand involved in the present situation.

The critical condition of the trade, owing to the sharp rise in prices of material of all lines and the restriction due to Government action were the reasons for the recent meeting of representatives of building trades at Atlantic City, called by the United States Chamber of Commerce. The progress made by all Government war work has been so far beyond expectations that the demand on raw and other materials has exceeded the most farseeing estimates. This has produced advances in prices, where such advances were possible, and has brought pressure to bear on those prices already fixed by the Government. The report from the coal fields, however, that coal production will probably meet the shortage threatened for next winter, and the recent announcement by the food administrator that the food problem has been solved, will probably have a corresponding reaction on prices.

Prices May Be Higher

Prices will probably be forced to still higher levels by the recently announced housing program, provided for in a $110,000,000 appropriation, and the depleted stocks of nonferrous materials, especially cement. The fact that steel is strictly preëmpted by the Government for ship construction, shell and other war supplies, and that the Federal levies will continue to be high, will probably have a corresponding effect. The volume of building construction for this reason will probably not be more than $350,000,000 for the year exclusive of Government building operations, which, together with the housing problem, has created a situation such that manufacturers of the building commodities are calling for revisions and new rulings on these lines by Government officials. They are urging priority rulings that will make possible the production of these commodities in larger quantities. If such rulings are deferred they say a price reaction will be produced that will seriously affect even Government operations.

At the beginning of the month the Price Fixing Board, as the result of the urgent request of the copper producers, advanced the price of copper from 23½c. to 26c.

The ability of the country to produce shipyards and ships has gone so far beyond expectations and estimates that, although the steel producers are realizing the predicted maximum output, the demand on steel has become such that the probability of a surplus is entirely gone. Mr. Hurley and Mr. Schwab are urging steel producers to do all in their power to meet the demand but the representatives of steel industries say that a readjustment of prices by the War Industries Board is necessary. A conference will shortly be held by Mr. Replogle of the War Industries Board and steel manufacturers, for the purpose of fixing prices on steel rails, wire ropes, castings and other steel products. The current reports of the Bridge Builders' and Structural Society indicate that nearly two-thirds of the entire capacity of the bridge and structural shops has been contracted for. These demands are having such a large effect on the steel reserve that a revision of the Governmental estimates of steel for the rest of 1918 is considered necessary, the shipping board alone asking for a reserve of 1,250,000 tons.

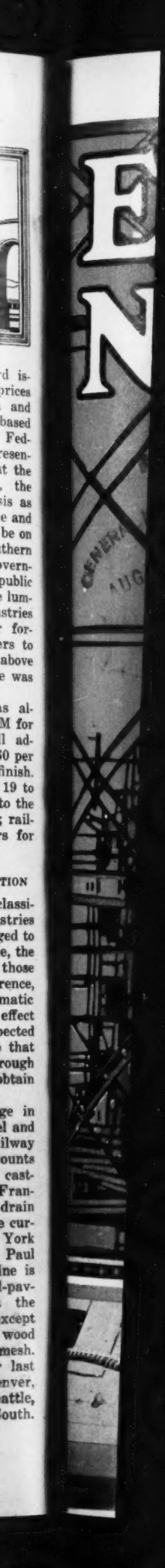
Charges of Profiteering Answered

Charges of profiteering recently made by the Federal Trade Commission regarding Southern lumber caused a protest from President Charles S. Keith of the Southern Pine Association. He pointed out that the companies forming the association with capital amounting to $170,000,000 and which produced 2,500,000,000 ft. of lumber annually, made a margin of $3.53 per M. on their shipments last year. He also pointed out that, although various economic reports show that the increase in commodities in the year of 1918 over that of 1913 amounted to 100%, the increase in Southern pine lumber amounted to only 39% for the same period. $3.00 per M. however is the margin computed as reasonable by the Federal Trade Commission.

During July the price-fixing committee of the War Industries Board issued a new scale of maximum prices for long and short-leaf Virginia and Carolina pine. These prices are based on information submitted by the Federal Trade Commission and representatives of the industry throughout the country. With few exceptions, the prices are fixed on the same basis as the list published for Southern pine and the prices to the Government will be on the same increase as that of Southern pine, so that the price to the Government will be higher and to the public lower. A request by the wholesale lumber dealers to the War Industries Board for relief from the order forbidding manufacturers and dealers to accept orders for mill shipment above the maximum prices fixed in June was refused.

The price-fixing committee has allowed an increase of about $4 per M for New England spruce. This will advance the prices to about $38 to $60 per M according to size, length and finish. These prices will hold from July 19 to November 1, 1918, and will apply to the American Government; the Allies; railroads and other lumber customers for all mill shipments.

Changes in Priority Classification

Recent changes in the priority classifications made by the War Industries Board, in which Class C was changed to include items entitled to preference, the addition of Class D, to take those which are not entitled to preference, and the establishment of automatic ratings, will probably have some effect on prices. These changes are expected to proivde a wider distinction, so that production will be stimulated through the ability of some industries to obtain the necessary raw materials.

The price list shows no change in pig iron, railway supplies and steel and iron pipe, except one item in railway ties and some change in the discounts for steel products. The price of cast-iron pipe was advanced in San Francisco and Dallas, Tex., and clay drain tile has advanced in St. Louis. The current prices of sewer pipe in New York and St. Louis, Boston and St. Paul have advanced, but a slight decline is noted in Seattle, Wash. In road-paving and construction materials the prices are generally stationary, except a slight advance in asphaltum, wood paving block, lime and triangle mesh. Brick prices have advanced over last month in New York, St. Louis, Denver, Boston, St. Paul, Kansas City, Seattle, Cincinnati and in places in the South.